PB90-234287

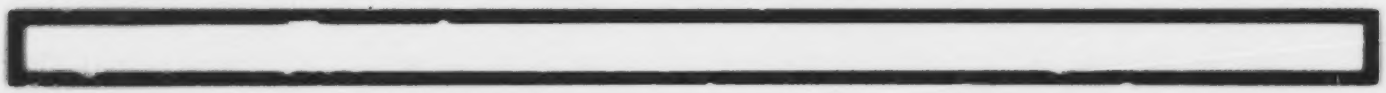
Best Demonstrated Available Technology (BDAT) Background Document for Wastes from the Production of Chlorinated Aliphatics F025. Volume 1

Versar, Inc., Springfield, VA

Prepared for:

Environmental Protection Agency, Washington, DC

May 90



U.S. Department of Commerce
National Technical Information Service
NTIS

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/530-SW-90-060A	2.	3. PB90-234287
4. Title and Subtitle FINAL BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT) BACKGROUND DOCUMENT FOR WASTES FROM THE PRODUCTION OF CHLORINATED ALIPHATICS F025			5. Report Date MAY 1990 6.
7. Author(s) ROSENGRANT/EBY/OSW			8. Performing Organization Rept. No
9. Performing Organization Name and Address U.S. EPA Office of Solid Waste 401 M. Street SW Washington, DC 20460			10. Project/Task/Work Unit No. 11. Contract(C) or Grant(G) No. (C) (G) 68-W9-0068
12. Sponsoring Organization Name and Address VERSAR, INC.			13. Type of Report & Period Covered BACK. DOCU. 5/90 14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

This background document provides the Agency's rationale and technical support for selecting the constituents to be regulated in F025 and for developing treatment standards for these constituents. Section 2 presents waste-specific information, i.e., the industry affects and waste characterization. Section 3 discusses the applicable and demonstrated technologies use dot treat the waste (or similar wastes) and section 4 summarizes the available performance data, including data on which the treatment standards are based. Section 5 explains EPA's determination of BDAT, while Section 6 discusses the calculation of BDAT treatment standards.

17. Document Analysis a. Descriptors

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL
INFORMATION SERVICE
SPRINGFIELD, VA 22161

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
RELEASE UNLIMITED	UNCLASSIFIED	73
	20. Security Class (This Page) UNCLASSIFIED	22. Price 0

(See ANSI-Z39.18)

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)

EPA/530-SW-90-060A
PB90-234287

FINAL
BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)
BACKGROUND DOCUMENT
FOR WASTES FROM THE PRODUCTION OF

CHLORINATED ALIPHATICS
F025

Larry Rosengrant, Chief
Treatment Technology Section

Elaine Eby
Project Manager

U.S. Environmental Protection Agency
Office of Solid Waste
401 M Street, S.W.
Washington, DC 20460

May 1990

ACKNOWLEDGMENTS

This document was prepared for the U.S. Environmental Protection Agency, Office of Solid Waste, by Versar Inc. under Contract No. 68-W9-0068. Mr. Larry Rosengrant, Chief, Treatment Technology Section, Waste Treatment Branch, served as the EPA Program Manager during the preparation of this document. The technical project officer for the waste was Ms. Elaine Eby. Mr. Steven Silverman served as legal advisor.

Versar personnel involved in the preparation of this document included Mr. Jerome Strauss, Program Manager; Mr. Stephen Schwartz, Assistant Program Manager; Mr. Stanley Moore, Principal Investigator and Author; Ms. Justine Alchowiak, Quality Assurance Officer; Ms. Martha M. Martin, Technical Editor; and Ms. Sally Gravely, Program Secretary.

TABLE OF CONTENTS

Section		Page No.
1.	INTRODUCTION	1-1
2.	INDUSTRY AFFECTED AND WASTE CHARACTERIZATION	2-1
	2.1 Industry Affected and Process Description	2-1
	2.2 Waste Characterization	2-3
	2.3 Treatability Group	2-4
3.	APPLICABLE AND DEMONSTRATED TREATMENT TECHNOLOGIES	3-1
	3.1 Applicable Treatment Technologies	3-1
	3.1.1 Nonwastewaters	3-1
	3.1.2 Wastewaters	3-4
	3.2 Demonstrated Treatment Technologies	3-7
	3.2.1 Nonwastewaters	3-7
	3.2.2 Wastewaters	3-8
4.	PERFORMANCE DATA BASE	4-1
	4.1 Nonwastewaters	4-5
	4.2 Wastewaters	4-26
5.	IDENTIFICATION OF BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)	5-1
6.	CALCULATION OF BDAT TREATMENT STANDARDS	6-1
7.	REFERENCES	7-1

LIST OF TABLES

		Page No.
Table 1-1	BDAT Treatment Standards for F025 (Nonwastewaters) Light Ends Subcategory	1-7
Table 1-2	BDAT Treatment Standards for F025 (Wastewaters) Light Ends Subcategory	1-7
Table 1-3	BDAT Treatment Standards for F025 (Nonwastewaters) Spent Filters/Aids and Desiccants Subcategory	1-8
Table 1-4	BDAT Treatment Standards for F025 (Wastewaters) Spent Filters/Aids and Desiccants Subcategory	1-8
Table 2-1	F025 Waste Characterization	2-3
Table 2-2	Waste Management/Location	2-5
Table 4-1	Treatment Performance Data Collected by EPA for K019 (Plant A - Rotary Kiln Incinerator, Sample Set #1)	4-5
Table 4-2	Treatment Performance Data Collected by EPA for K019 (Plant A - Rotary Kiln Incinerator, Sample Set #2)	4-6
Table 4-3	Treatment Performance Data Collected by EPA for K019 (Plant A - Rotary Kiln Incinerator, Sample Set #3)	4-7
Table 4-4	Treatment Performance Data Collected by EPA for K019 (Plant A - Rotary Kiln Incinerator, Sample Set #4)	4-8
Table 4-5	Treatment Performance Data Collected by EPA for K019 (Plant A - Rotary Kiln Incinerator, Sample Set #5)	4-9
Table 4-6	Treatment Performance Data Collected by EPA for K019 (Plant A - Rotary Kiln Incinerator, Sample Set #6)	4-10
Table 4-7	Wastewater Treatment Performance Data for Chloroform	4-22

LIST OF TABLES (CONTINUED)

		Page
Table 4-8	Wastewater Treatment Performance Data for 1,2-Dichloroethane	4-24
Table 4-9	Wastewater Treatment Performance Data for 1,1-Dichloroethylene	4-25
Table 4-10	Wastewater Treatment Performance Data for Methylene Chloride	4-26
Table 4-11	Wastewater Treatment Performance Data for Carbon Tetrachloride	4-28
Table 4-12	Wastewater Treatment Performance Data for 1,1,2-Trichloroethane	4-29
Table 4-13	Wastewater Treatment Performance Data for Trichloroethene	4-30
Table 4-14	Wastewater Treatment Performance Data for Vinyl Chloride	4-33
Table 4-15	Wastewater Treatment Performance Data for Hexachloroethane	4-33
Table 4-16	Wastewater Treatment Performance Data for Hexachlorobenzene	4-33
Table 4-17	Wastewater Treatment Performance Data for Hexachlorobutadiene	4-33
Table 6-1	Calculation of Treatment Standards for F025 (Nonwastewaters)	6-8
Table 6-2	Calculation of Treatment Standards for F025 (Wastewaters)	6-9

LIST OF APPENDIXES

		Page No.
Appendix A	Matrix Spike Recovery Data for K001 and K019 Nonwastewaters	A-1
Appendix B	Discussion of Determination of BDAT for F025 Wastewater Constituents	B-1

LIST OF FIGURES

Figure 2-1	Generic Flow Diagram for Processes Generating F024 and F025	2-2

1. INTRODUCTION

In accordance with the amendments to the Resource Conservation and Recovery Act (RCRA) of 1976, enacted in the Hazardous and Solid Waste Amendments (HSWA) of November 8, 1984, the Environmental Protection Agency (EPA) is promulgating best demonstrated available technology (BDAT) treatment standards for F025 wastes. The listing of F025 as a RCRA hazardous waste will become effective June 11, 1990. EPA has therefore decided to promulgate concentration-based treatment standards for F025 waste with the Third Third rulemaking. According to the December 11, 1989, Federal Register notice, F025 wastes will be listed as condensed light ends, spent filters and filter aids, and spent desiccant wastes from the production of certain chlorinated aliphatic hydrocarbons by free radical catalyzed processes having carbon chain lengths ranging from one to five.

This background document provides the Agency's rationale and technical support for selecting the constituents to be regulated in F025 and for developing treatment standards for these constituents. Section 2 presents waste-specific information, i.e., the industry affected and waste characterization. Section 3 discusses the applicable and demonstrated technologies used to treat the waste (or similar wastes), and Section 4 summarizes the available performance data, including data on which the treatment standards are based. Section 5 explains EPA'S determination of BDAT, while Section 6 discusses the calculation of BDAT treatment standards.

The Agency's legal authority and promulgated methodology for establishing treatment standards and the petition process necessary for requesting a variance from the treatment standards are summarized in EPA's Methodology for Developing Best Demonstrated Available Technology (BDAT) Treatment Standards (USEPA 1989b).

F025 waste, although not officially listed at the writing of this document, will be listed on June 11, 1990, as condensed light ends, spent filters and filter aids, and spent desiccant wastes from the production of certain chlorinated aliphatic hydrocarbons having chain lengths ranging from one to five. Note that earlier the Agency proposed listing F025 as "light ends" but now is planning to narrow the listing to include only "condensed light ends." Industry profile information is available in the Listing Background Document for Chlorinated Aliphatics, which include F024 waste, for which BDAT treatment standards were promulgated as part of the Second Third rulemaking.

Detailed waste information is available in EPA Confidential Business Information (CBI) report RE8401270, Waste Management Assessment of the Chlorinated Aliphatics Industry, (December 1983), and CBI memorandum BP8501952, Economic Impact Screening Analysis of the Chlorinated Aliphatics Listing, (March 31, 1985). Persons with CBI clearance may request CBI information from the U.S. Environmental Protection Agency, Office of Policy, Planning, and Information (attention: Dina Villari).

The Agency is regulating eight organic constituents in F025 nonwastewaters and wastewaters in the light ends subcategory and nine organic constituents in F025 nonwastewaters and wastewaters in the spent filters/aids and desiccants subcategory. (See Tables 1-1 through 1-4 at the end of this section.) To determine the applicability of the treatment standards, F025 wastewaters are defined as wastes containing less than 1 percent (weight basis) total suspended solids* and less

---

* The term "total suspended solids" (TSS) clarifies EPA's previously used terminology of "total solids" and "filterable solids." Specifically, total suspended solids is measured by Method 209C (total suspended solids dried at 103-105°C) in Standard Methods for the Examination of Water and Wastewater, 16th Edition (APHA, AWWA, and WPCF 1985).

than 1 percent (weight basis) total organic carbon (TOC). Wastes not meeting this definition are classified as nonwastewaters and must comply with the nonwastewater treatment standards which will become effective December 11, 1990.

For F025 nonwastewaters, BDAT treatment standards are based on treatment performance data transferred from K001 (creosote), and K019 incineration performance data. For today's final rulemaking the F025 wastewaters BDAT treatment standards are based on treatment performance data transferred from EPA's Final Best Demonstrated Available Technology (BDAT) Background Document for Wastewater forms of Organic U and P wastes and Multisource Leachates (F039) For Which There Are Concentration-Based Treatment Standards, Volume A.

For the proposed rule the Agency proposed wastewater standards for F025 wastewaters based on treatment performance data from incinerator scrubber water residuals. The Agency noted, however, that for the final rule these wastewater standards may change based on the alternative treatment performance data from the treatment of various wastewaters data. A discussion of the revised F025 wastewater treatment standards based on the treatment performance data transferred from the Final Best Demonstrated Available Technology (BDAT) Background Document for Wastewater Forms Of Organic U and P Wastes and Multisource Leachates (F039) For Which There Are Concentration-Based Treatment Standards, Volume A is presented below.

In the final rule for the Land Disposal Restrictions for Third Third Wastes, EPA is promulgating concentration-based treatment standards for many wastewater forms of RCRA hazardous wastes including wastes identified with either an F, K, U, or P. In section III.A.1.(h)(6) of the proposed rule for Third Third wastes (54 FR 48390 (November 22,

1989)), the Agency specifically proposed two alternative sets of concentration-based standards for the majority of the U and P wastewaters for which concentration-based standards could be established.

One set of standards for the U and P wastewaters (along with the standards for most of the F and K wastewaters) were based on the concentration of these constituents as measured in incinerator scrubber water where specific RCRA hazardous nonwastewaters containing these constituents (or similar constituents) were incinerated. (These standards were proposed primarily in sections III.A.2 and 3. of the proposed rule.)

An alternate set of standards was based on a transfer of treatment performance data for wastewaters containing these constituents (or similar constituents) from various data sources including: (1) the Office of Water's Industrial Technology Division (ITD) and National Pollution Discharge Elimination System (NPDES) data (specifically from the Organic Chemicals, Plastics, and Synthetic Fibers (OCPSF) data base); (2) the Hazardous Waste Engineering Research Laboratory (HWERL) data base; (3) the Office of Solid Waste's BDAT data (from previous land disposal restrictions rules); and (4) additional wastewater treatment data from literature articles on wet air oxidation and PACT. These alternative wastewater treatment standards were presented in section III.A.7. of the proposed Third Third Rule (54 FR 48467) as treatment standards for wastewater forms of multisource leachate, but were specifically identified as alternative standards for U and P wastewaters. Additional data from the treatment of multisource leachate were received just prior to proposal and were placed in the administrative record. EPA specifically solicited public comment on these treatment data (54 FR 48463 and 48464).

As stated in the Final Rule for Land Disposal Restrictions for Second Third Wastes (54 FR 26629) and reiterated in the proposed rule for Third Third Wastes (54 FR 48390), when the Agency has appropriate wastewater treatment data from well-designed and well-operated wastewater treatment units, it prefers to use these data rather than scrubber water concentrations to develop wastewater treatment standards. (Note: This does not, however, preclude the Agency from establishing treatment standards for other wastes based on constituent concentrations in incinerator scrubber waters, and has done so for many F and K wastes and some U and P wastes in the final rules for First Third and Second Third Wastes.)

Commenters to the proposed rules for First Third, Second Third, and Third Third Wastes almost unanimously supported that EPA should promulgate wastewater standards based on the performance of specific wastewater treatment rather than incinerator scrubber water constituent levels. After reviewing all available data and comments, the Agency agrees with this comment, and is promulgating concentration-based treatment standards based on wastewater treatment data rather than scrubber water for all wastes that were proposed in the rule for Third Third Wastes. While the Agency did not specifically identify the standards based on wastewater treatment data as alternatives for F and K wastewaters, the Agency believes that this is a logical outgrowth of the notice and comment process.

More detailed information on the technical development of the constituent specific treatment standards for wastewaters can be found in the background document entitled BDAT Background Document for Wastewaters Containing BDAT List Constituents.

The tables following this section list the specific BDAT treatment standards for the F025 nonwastewaters and wastewaters light ends subcategory and the spent filters/aids and desiccants subcategory. The

treatment standards reflect the total concentration of each organic constituent regulated in F025 wastes. The units used for total constituent concentration are mg/kg (parts per million on a weight-by-weight basis) for nonwastewaters and mg/l (parts per million on a weight-by-volume basis) for wastewaters.

Table 1-1 BDAT Treatment Standards for F025
(Nonwastewaters)
Light Ends Subcategory

Regulated constituent	Maximum for any single grab sample Total composition (mg/kg)
Chloroform	6.2
Carbon tetrachloride	6.2
1,2-Dichloroethane	6.2
1,1-Dichloroethylene	6.2
Methylene chloride	31
1,1,2-Trichloroethane	5.6
Trichloroethylene	5.6
Vinyl chloride	33

Table 1-2 BDAT Treatment Standards for F025
(Wastewaters)
Light Ends Subcategory

Regulated constituent	Based on composite samples Total composition (mg/l)
Chloroform	0.046
Carbon tetrachloride	0.057
1,2-Dichloroethane	0.21
1,1-Dichloroethylene	0.025
Methylene chloride	0.089
1,1,2-Trichloroethane	0.054
Trichloroethylene	0.054
Vinyl chloride	0.27

Table 1-3 BDAT Treatment Standards for F025
(Nonwastewaters)
Spent Filters/Aids and Desiccants Subcategory

Regulated constituent	Maximum for any single grab sample Total composition (mg/kg)
Chloroform	6.2
Carbon tetrachloride	6.2
Hexachlorobenzene	37
Hexachlorobutadiene	28
Hexachloroethane	30
Methylene chloride	31
1,1,2-Trichloroethane	6.2
Trichloroethylene	5.6
Vinyl chloride	33

Table 1-4 BDAT Treatment Standards for F025
(Wastewaters)
Spent Filters/Aids and Desiccants Subcategory

Regulated constituent	Based on composite samples Total composition (mg/l)
Chloroform	0.046
Carbon tetrachloride	0.057
Hexachlorobenzene	0.055
Hexachlorobutadiene	0.055
Hexachloroethane	0.055
Methylene chloride	0.21
1,1,2-Trichloroethane	0.054
Trichloroethylene	0.054
Vinyl chloride	0.27

2. INDUSTRY AFFECTED AND WASTE CHARACTERIZATION

This section describes the industry affected by the land disposal restrictions for F025 wastes and presents available characterization data for this waste. At the writing of this document, F025 was not currently listed in 40 CFR; however, F025 will be officially listed on June 11, 1990, as follows: condensed light ends, spent filters and filter aids, and spent desiccant wastes from the production of certain chlorinated aliphatic hydrocarbons by free radical catalyzed processes having carbon chain lengths ranging from one to five.

2.1 Industry Affected and Process Description

The listing background document for F024 specifies that F024 wastes include, but are not limited to, distillation residue, heavy ends, tars, and reactor clean-out wastes from the production of chlorinated aliphatic hydrocarbons utilizing free radical catalyzed processes that carbon chain lengths ranging from one to five carbons . The F024 listing does not include (among other components) the condensed light ends, spent filters and filter aids, and spent desiccant wastes, which will be listed as F025 wastes.

Since the production processes for F025 wastes are likely to be similar to that for F024, see Section 2 of the Best Demonstrated Available Technology Background Document for Chlorinated Aliphatics F024 (USEPA 1989g) for generic information concerning process description and facilities that are likely to generate wastes from the production of chlorinated aliphatic hydrocarbons. Figure 2-1 presents a generic process diagram of the production of one to five carbon chain (C-1 to C-5) chlorinated aliphatic hydrocarbons, which generates F024. This diagram shows the light ends and filters that are expected to be components of the F025 wastes.

Reproduced from
best available copy.

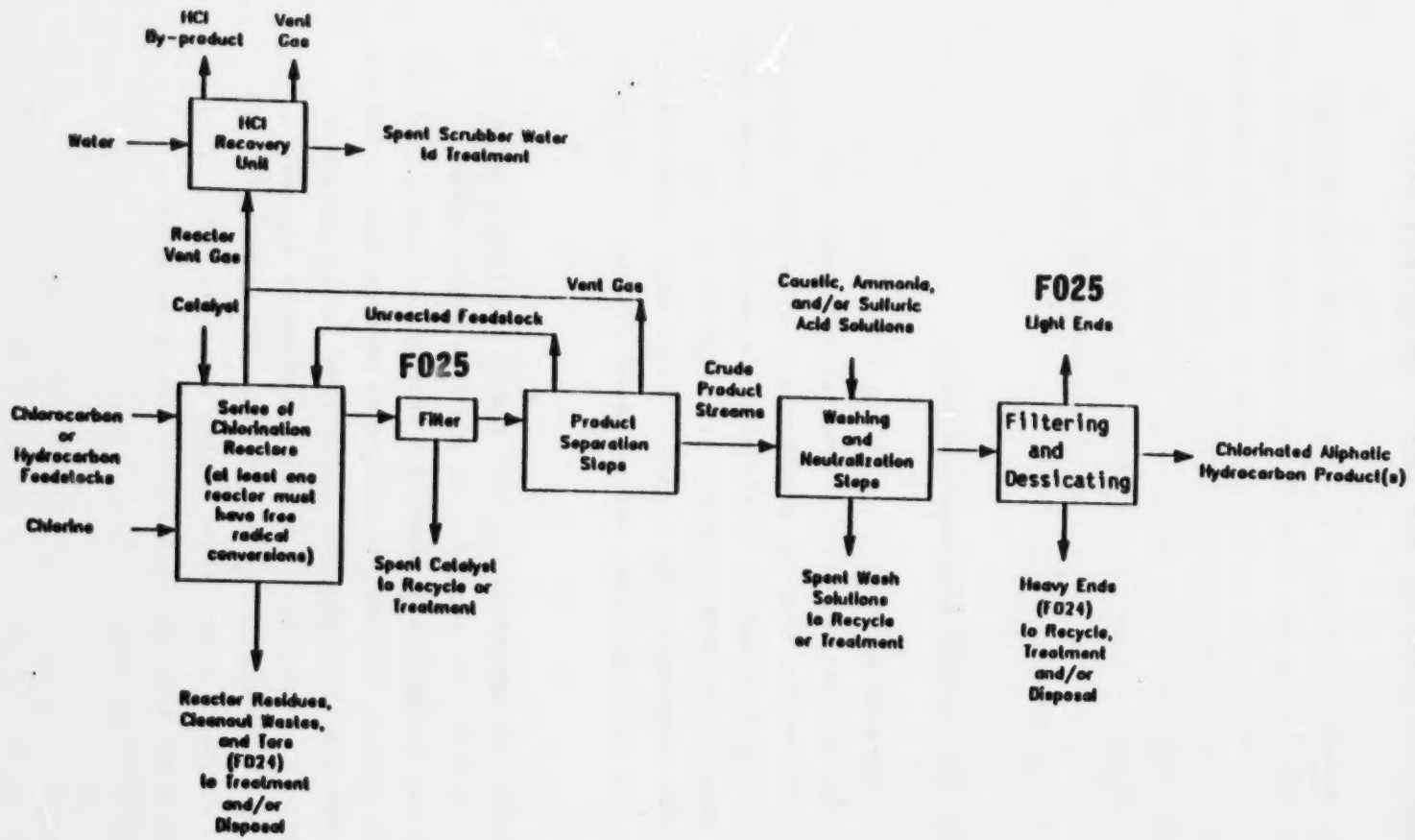


Figure 2-1. Generic Flow Diagram for Processes Generating F024 and F025

2.2 Waste Characterization

Waste characterization for F025 is incomplete since only part of the industry was surveyed and generators did not provide complete information. However, Table 2-1 summarizes the available data for F025 wastes.

Table 2-1 F025 Waste Characterization[a]

Constituents	Light ends	Filters/Aids	Desiccants
1,1,2-Trichloroethane	0.01-0.1%	D	-
1,1-Dichloroethylene	0.1-1%	-	-
1,2-Dichloroethane	1-25%	-	-
Carbon tetrachloride	0.1-50%	0.1-1%	0.01-50%
Chloroethane	1-50%	-	-
Chloroform	10-50%	0.0001-10%	0.01-50%
Hydrogen chloride	>50%	-	-
Hexachlorobenzene	-	-	0.62 ppm
Hexachlorobutadiene	-	3.6 ppm	1-3.6 ppm
Hexachloroethane	-	-	350 ppm
Methylene chloride	0.01-1.3%	0.1-10%	0.01-50%
Trichloroethylene	0.09%	-	4 ppm
Vinyl chloride	10->50%	D	-

D = Detected
- = No data available.

[a]Some of the data ranges were expanded to help conceal Confidential Business Information.
References: Dynamac Corporation, 1989, USEPA 1984.

As previously mentioned, the data for F025 waste are incomplete; however, the Listing Document for Chlorinated Aliphatics lists the waste volume of F025 as 29,000 metric tons, which is about one-third of the 100,000 metric tons calculated from the support data. Since EPA is now going to list only condensed light ends and associated filter aids, the actual volumes will be less than the data shown in Table 2-2, which are estimates based on industry surveys and engineering assumptions.

Table 2-2

Waste Management/Location

	Incinerator Onsite (%)	Incinerator Offsite (%)	Landfill Offsite (%)	Recycle/Reuse Onsite (%)	Volume (kkg/yr)
Light Ends	18	2	-	80	99,566
Filters/Aids	19	-	81	-	422
Dessicants	-	-	38	62	300
Total					100,288

- = No data available.

Reference: USEPA 1984.

2.3 Treatability Group

EPA bases its treatability group decisions primarily on whether wastes are generated by the same or similar industries and from similar processes. EPA believes that such groupings can be made because of the high probability that waste characteristics that affect treatment performance will be similar for different types of F025 wastes and, therefore, similar levels of treatment performance can be achieved. Based on the anticipated similarities among industries and processes

generating F025, the Agency has categorized F025 waste as a single treatability group identified as chlorinated aliphatic hydrocarbons. For the purpose of establishing treatment standards, F025 wastes have been grouped into two subcategories: condensed light ends and filters/aids and desiccants. Available characterization data suggest that different constituents may be contained in each of these subcategories. Consequently, the Agency is promulgating concentration-based treatment standards to reflect these differences in physical and chemical composition. As a result, EPA is promulgating treatment standards for these two subcategories identified in Tables 1-1 to 1-4.

3. APPLICABLE AND DEMONSTRATED TREATMENT TECHNOLOGIES

This section identifies the treatment technologies that are applicable to the F025 wastes and determines which, if any, of the applicable technologies can be considered demonstrated for the purpose of establishing BDAT.

To be applicable, a technology must be theoretically usable to treat the waste in question or to treat a waste that is similar in terms of the parameters that affect treatment selection. (For detailed descriptions of the technologies applicable for these wastes, or for wastes judged to be similar, see EPA's Treatment Technology Background Document (USEPA 1989f).) To be demonstrated, the technology must be employed in full-scale operation for the treatment of the waste in question or a similar waste. Technologies that are available only at research facilities or at pilot- and bench-scale operations are not considered in identifying demonstrated technologies.

3.1 Applicable Treatment Technologies

The following subsections present applicable treatment technologies for F025 wastes (nonwastewaters and wastewaters).

3.1.1 Nonwastewaters

Since nonwastewater forms of these wastes contain hazardous organic constituents at treatable concentrations, applicable treatment technologies include those that destroy or reduce the total amount of various organic compounds in the waste. The Agency has identified the following treatment technologies as applicable for these wastes: (1) incineration (fluidized bed, rotary kiln, and liquid injection); (2) solvent extraction followed by incineration or recycle of the extract and/or raffinate (residual); (3) critical fluid extraction followed by

incineration; (4) wet air oxidation; (5) chemical oxidation; and (6) distillation. A seventh technology, total recycle or reuse, may also be applicable for F025 waste. These treatment technologies were identified based on current waste treatment practices and engineering judgment.

(1) Incineration. Incineration is a destruction technology in which energy, in the form of heat, is transferred to the waste to destabilize chemical bonds and destroy hazardous organic constituents. In a fluidized bed incinerator, waste is injected into the fluidized bed material (generally sand and/or incinerator ash), where it is heated to its ignition temperature. Heat energy from the combustion reactions is then transferred back to the fluidized bed. Ash is removed periodically during operation and during bed change-outs.

In a rotary kiln incinerator, waste is fed into the elevated end of the kiln, and the rotation of the kiln mixes the waste with hot gases to heat the waste to its ignition temperature. Ash is removed from the lower end of the kiln. Combustion gases from the kiln enter the afterburner for complete destruction of waste constituents. Other wastes may also be injected into the afterburner.

In a liquid injection incinerator, liquid wastes are atomized and injected into the incinerator. In general, only wastes with low or negligible ash content are amenable to liquid injection incineration. Therefore, this technology generally does not result in the generation of a significant ash residual.

Combustion gases from most incinerators are fed to a scrubber system for cooling and removal of entrained particulates and acid gases, if present. In general, with the exception of liquid injection incineration, two residuals are generated by incineration processes: ash and scrubber water.

(2) Solvent extraction. Solvent extraction is a separation technology whereby a contaminant dissolved in a liquid waste is transferred from the waste to an extracting solvent that dissolves the contaminant. For solvent extraction to be effective, the extracting solvent must not be significantly miscible in the waste to be treated and must differ in density so that phase separation is possible. This technology results in the generation of two residuals: a treated waste residual (raffinate) and an extract. The extract and/or raffinate may be recycled or treated by incineration.

(3) Critical fluid extraction. Critical fluid extraction is a solvent extraction technology in which the solvent (which is generally liquified gas at or beyond its critical state) is used to extract hazardous organic constituents from the wastes in the same way as solvent extraction above. After the extraction step, the solvent is brought back to its normal (ambient pressure) condition in the gaseous state, generating a small volume of extract that is concentrated in hazardous organic constituents. This technology results in the generation of two residuals: a treated waste (raffinate) and an extract. The extract may be recycled or treated by incineration. The raffinate can usually be incinerated.

(4) Wet air oxidation. Wet air oxidation is a destruction technology in which hazardous organic constituents in wastes are oxidized and destroyed under pressure at elevated temperatures in the presence of dissolved oxygen. This technology is applicable for wastes composed primarily of water and having up to 10 percent total organic concentration. Wet air oxidation results in the formation of one treatment residual: treated effluent. The treated effluent may require further treatment for hazardous organic constituents by biological treatment and/or carbon adsorption or other wastewater treatment technologies.

(5) Chemical oxidation. Chemical oxidation is a treatment technology that may be used to treat wastes containing organics and, in some cases, to treat sulfide and cyanide wastes. The basic principle of chemical oxidation is that some dissolved organic compounds, inorganic cyanides, and sulfides are chemically oxidized to yield carbon dioxide, water, salts, single organic acids, and, in the case of sulfides, sulfates. The principal chemical oxidants used are hypochlorite, chlorine gas, chlorine dioxide, hydrogen peroxide, ozone, and potassium permanganate.

(6) Distillation. Distillation is the vaporization of one or more volatile components out of liquid solution by the application of heat. Individual components vaporize in order of their volatility so that relatively pure products result upon condensation of the volatilized components. Organic products that were volatilized are typically purified and recovered. Nonvolatile residues of less volatile components remain behind in the distillation vessel bottoms, which typically are incinerated.

(7) Total recycle or reuse. Total recycle or reuse of a waste in the same process from which it originated, or another process, eliminates the generation of the waste and ideally generates no treatment residuals.

3.1.2 Wastewaters

Since wastewater forms of F025 wastes contain hazardous organic constituents at treatable concentrations, applicable technologies include those that destroy or reduce the total amount of various organic compounds in the waste. Therefore, the Agency has identified the following treatment technologies as potentially applicable for treatment of these wastes: (1) incineration, (2) wet air oxidation, (3) chemical oxidation, (4) biological treatment, (5) carbon adsorption, (6) solvent

extraction, (7) distillation, and (8) steam stripping. A ninth technology, total recycle or reuse, may also be applicable for F025 wastewaters. These treatment technologies were identified based on current waste treatment practices and engineering judgment.

Application of these technologies is often dependent upon the concentrations and types of waste constituents present in the waste. Carbon adsorption, for example, is often used as a polishing step following primary treatment by biological treatment, solvent extraction, or wet air oxidation. Typically, carbon adsorption is applicable for treatment of wastewaters containing less than 0.1 percent total organic concentration. Typically, wet air oxidation, biological treatment, and solvent extraction are applicable for treatment of wastewaters containing up to 1 percent total organic concentration.

(1) Incineration. Incineration of wastewaters is identical to that of nonwastewaters as described previously in Section 3.1.1. EPA believes that incineration may be an applicable technology for F025 wastewaters because incineration typically provides significant destruction (even for wastewaters) and some of these wastewaters may actually contain high concentrations of carbon (near 1 percent total organic carbon (TOC)).

(2) Wet air oxidation. Wet air oxidation of wastewaters is identical to that of nonwastewaters as described previously in Section 3.1.1.

(3) Chemical oxidation. Chemical oxidation of wastewaters is identical to that of nonwastewaters as described previously in Section 3.1.1.

(4) Biological treatment. Biological treatment is a technology that uses living microorganisms to decompose organic constituents.

Biological treatment can occur either in the presence of oxygen, known as aerobic treatment, or in the absence of oxygen, known as anaerobic treatment. In aerobic treatment the organic constituents are broken down by the microorganisms into water, carbon dioxide, and lower molecular weight organic components. In anaerobic treatment the organic constituents are broken down into water, methane, and other organic components.

(5) Carbon adsorption. Carbon adsorption is a separation technology in which hazardous organic constituents in wastewaters are selectively adsorbed onto activated carbon. This technology results in the formation of two treatment residuals: a treated effluent and spent activated carbon.

(6) Solvent extraction. Solvent extraction of wastewaters is identical to that of nonwastewaters as described previously in Section 3.1.1.

(7) Distillation. Distillation of wastewaters is identical to that of nonwastewaters as described previously in Section 3.1.1.

(8) Steam stripping. Steam stripping is a technology that can separate more volatile materials from less volatile materials by vaporizing the more volatile materials and then condensing them. As such, it is a type of distillation process.

(9) Total recycle or reuse. Total recycle or reuse of wastewaters is identical to that of nonwastewaters as described previously in Section 3.1.1.

3.2 Demonstrated Treatment Technologies

The following subsections present demonstrated treatment technologies for F025 nonwastewaters and wastewaters.

3.2.1 Nonwastewaters

The Agency has identified incineration as a demonstrated technology for treatment of similar nonwastewater forms of halogenated aliphatic wastes, i.e., K019, F024, and various other aliphatic wastes. Incineration is demonstrated on a full-scale operational basis for treatment of the above-mentioned nonwastewater waste codes and other wastes in the halogenated aliphatic treatability group, as determined by review of the data from many of the treaters of these wastes identified in the 1986 National Survey of Treatment, Storage, Disposal, and Recycling Facilities (TSDR Survey). For the land disposal restrictions program First, Second, and Third Third scheduled wastes, the Agency tested rotary kiln incineration for treatment of many halogenated aliphatic wastes similar to F025.

From review of the 1986 TSDR Survey and EPA's Water Engineering Research Laboratory data base, the Agency determined that some facilities also treat wastes judged to be similar to F025, i.e., K019, F024, and various aliphatic U-wastes, on a full-scale operational basis using incineration, wet air oxidation, chemical oxidation, and distillation; therefore, EPA believes that these technologies are also demonstrated for these wastes.

EPA does not have information on facilities using critical fluid extraction, solvent extraction, or total recycle or reuse for treatment of the constituents present in F025 wastes listed in Table 1-1 to 1-4,

and therefore the Agency believes that these treatment technologies are not currently demonstrated for F025 nonwastewaters.

3.2.2 Wastewaters

From review of the 1986 TSDR Survey, and data bases from EPA's Water Engineering Research Laboratory, the Best Demonstrated Available Technology Program, EPA's Industrial Technology Division, and the National Pollutant Discharge Elimination System, including performance data from Wet Air Oxidation and Powdered Activated Carbon Treatment, the Agency has determined that some facilities treat constituents of concern in F025 wastewaters (listed in Tables 1-1 through 1-4) using incineration, biological treatment, carbon adsorption, wet air oxidation, chemical oxidation, distillation, and steam stripping. Therefore, EPA believes that these technologies are demonstrated for the F025 wastewaters. Since neither the 1986 TSDR Survey nor any of the other above-mentioned data bases identified any facilities using critical fluid extraction, solvent recovery, or recycle/reuse, the Agency believes that these technologies are not demonstrated for F025 wastewaters.

4. PERFORMANCE DATA BASE

This section presents the data available on the performance of the demonstrated technologies in treating F025 wastes. These data are used elsewhere in this document for determining which technologies represent BDAT (Section 5) and for developing treatment standards (Section 6). Eligible data may include data developed at research facilities, or through other applications at less than full-scale operation, as long as the technology is demonstrated (as defined in Section 3.2) in full-scale operation for the similar waste or wastes.

Where data are not available on the treatment of the specific wastes of concern, the Agency may elect to transfer performance from the treatment of a similar waste or wastes, using the demonstrated performance data technology. EPA's methodology for the transfer of treatment performance data is provided in Methodology for Developing Best Demonstrated Available Technology (BDAT) Treatment Standards (USEPA 1989b). To transfer data from another waste category, EPA must find that the wastes covered by this background document are no more difficult to treat (based on the waste characteristics that affect performance of the demonstrated treatment technology) than the treated wastes from which performance data are being transferred.

4.1 Nonwastewaters

The performance data used to develop the treatment standards for the constituents in F025 nonwastewaters identified in Tables 1-1 through 1-4 (excluding vinyl chloride) are the same as the performance data used for K019 nonwastewaters, for which treatment standards were promulgated in the First Third rulemaking. The performance data used to develop the treatment standards for vinyl chloride in F025 are the F024 performance data for vinyl chloride. These data were also used to develop the U043 vinyl chloride treatment standard in the Third Third rulemaking.

In developing the treatment standards for F025, the Agency reviewed the treatability and detection limit data from several different incineration test burns conducted by EPA for various F and K wastes. (These data are available in the respective BDAT background documents for the waste codes identified below and may be accessed through the RCRA docket for the Third Third Land Disposal Restriction Rulemaking.) These data represent a myriad of different hazardous wastes that were generated and treated at several different incineration facilities.

The Agency determined that there were substantial treatment data for many of the F025 halogenated aliphatic constituents from the incineration of two particular waste codes: K019 (heavy ends from the distillation of ethylene dichloride in ethylene dichloride production) and F024 (various wastes from the production of certain halogenated aliphatics such as distillation residues, heavy ends, tars, and reactor clean-out wastes. There are also performance data for five of the halogenated aliphatic U-wastes from a June 1989 test burn. Treatment standards for K019 were promulgated in the First Third final rule on August 8, 1988; treatment standards for F024 were promulgated in the Second Third final rule on June 8, 1989. Data from the test burns of F024 and K019 and the June 1989 John Zink test burn included performance data/detection limits for many of the halogenated aliphatic constituents, ranging from low levels in some wastes to high levels in others. The Agency believes that these treatment data (presented in Tables 4-1 to 4-8) provide a sufficient range of concentration of halogenated aliphatic chemicals in untreated wastes to be considered appropriate for developing treatment standards for F025 wastes.

4.2 Wastewaters

The performance data used to develop the treatment standards for the constituents of concern in F025 wastewaters (identified in Tables 1-1 through 1-4) are from several sources, including the following: (1) EPA's Industrial Technology Division (ITD), (2) EPA's Water Engineering

Research Laboratory (WERL) database and literature sources, and (3) Wet Air Oxidation (WAO) and Powdered Activated Carbon Treatment (PACT) data. Additional discussion of these wastewater treatment data may be found in the Final BDAT Background Document for Organic U and P Wastes and Multi-Source Leachate For Which There Are Concentration-Based Treatment Standards Volume A. These treatment performance data represent bench-, pilot-, and full-scale data. Tables 4-9 through 4-19 (at the end of the section) present the treatment performance data used to develop the F025 wastewater treatment standards.

The Agency chose the ITD data to promulgate treatment standards for the following F025 wastewater constituents: chloroform, 1,2-dichloroethane, 1,1-dichloroethylene, methyene chloride, carbon tetrachloride, 1,1,2-trichloroethane, trichloroethylene, and vinyl chloride. The reasons for which the ITD database was selected are as follows:

(1) The ITD data represent treatment performance data from the EPA's Organic Chemical, Plastic, and Synthetic Fibers (OCPSF) sampling episodes. The data collected by ITD include long-term sampling of several industries. These data are therefore a good reflection of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The ITD data were carefully screened prior to inclusion in that data base. These data were used in determining an ITD promulgated limit.

(3) A promulgated ITD limit represents data that have undergone both EPA and industry review and acceptance.

For the F025 wastewater constituents hexachlorobenzene, hexachloroethane, and hexachlorobutadiene, the available performance data were from the WERL database. Because the performance data are from full-

scale treatment and showed significant removal efficiency, the Agency is using these data to develop the wastewater treatment standards for hexachlorobenzene, hexachloroethane, and hexachlorobutadiene.

Table 4-1 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #1 (Continued)

	Untreated Waste		Treated Waste	
	K019 Concentration	RCRA Blend* Concentration	Kiln Asn Concentration	Kiln Asn TCLP
Detected BDAT List Organic Constituents	mg/kg (ppm)	mg/kg (ppm)	mg/kg (ppm)	mg/L (ppm)
SEMIVOLATILES (Continued)				
111. Hexachlorobutadiene	<50	210	<10	
113. Hexachloroethane	120	<100	<10	
121. Napnthalene	470	<20	<2	
126. Nitrobenzene	<25	3,400	<5	
136. Pentachlorobenzene	61	<100	<10	
141. Phenanthrene	21	240	<2	
142. Phenol	<10	78	<2	
145. Pyrene	<10	200	<2	
148. 1,2,4,5-Tetrachlorobenzene	76	<50	<5	
150. 1,2,4-Trichlorobenzene	100	<50	<5	
Detected BDAT List Metal and Inorganic Constituents				
METALS				
154. Antimony	<6.0	24	8.0	<0.060
155. Arsenic	1.2	94	3.6	<0.002
156. Barium	0.97	1.3	26	0.033
158. Cadmium	0.63	<0.3	0.66	<0.003
159. Chromium	4.0	40	44	0.200
160. Copper	2.1	165	2,370	2.690
161. Lead	3.4	27	120	0.380
163. Nickel	3.0	8.8	66	0.680
165. Silver	<0.9	<0.9	3.3	<0.009
167. Vanadium	<2.0	2.2	4.1	<0.020
168. Zinc	5.8	4,170	12	0.052
INORGANICS				
169. Total Cyanide	<0.5	0.9	<0.47	
170. Fluoride	<5.0	31	38	
171. Sulfide	790	830	68	

*Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-1 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #1 (Continued)

DESIGN AND OPERATING PARAMETERS

Parameter	Design	Operating Value
Kiln Temperature (°F)	*	1825-1900
Kiln Solids Residence Time (min)	*	120
Waste Feed Rate (MMBTU/hr)	*	K019: 13.1 RCRA Blend, Waste Burner #1: 3.9-5.5 RCRA Blend, Waste Burner #2: 4.4-9.7
Kiln Rotational Speed (RPM)	*	0.19-0.21

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 4-2

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #2

Detected BDAT List Organic Constituents	Untreated Waste K019 Concentration mg/kg (ppm)	Untreated Waste RCRA Blend* Concentration mg/kg (ppm)	Treated Waste Kiln Ash Concentration mg/kg (ppm)
VOLATILES			
4. Benzene	<2,000	2,000	<2
7. Carbon tetrachloride	3,800	<8	<2
9. Chlorobenzene	<2,000	<8	<2
14. Chloroform	5,800	<8	<2
22. 1,1-Dichloroethane	<2,000	<8	<2
23. 1,2-Dichloroethane	96,000	<8	<2
34. Methyl ethyl ketone	<10,000	940	<10
38. Methylene chloride	<10,000	910	<10
42. Tetrachloroethene	6,700	490	<2
43. Toluene	<2,000	2,300	<2
45. 1,1,1-Trichloroethane	33,000	130	<2
47. Trichloroethene	2,400	360	<2
215-217. Xylene (total)	<2,000	3,400	<2
222. Acetone	<10,000	1,200	<10
226. Ethyl benzene	<2,000	2,200	<2
229. Methyl isobutyl ketone	<10,000	1,100	<10
SEMIVOLATILES			
51. Acenaphthalene	<10	150	<2
57. Anthracene	<10	110	<2
65. Benzo(k)fluoranthene	<10	67	<2
68. Bis(2-chloroethyl) ether	280	<20	<2
70. Bis(2-ethylhexyl) phthalate	<10	40	<2
80. Chrysene	SNA	28	<2
87. o-Dichlorobenzene	<10	250	<2
88. p-Dichlorobenzene	74	32	<2
98. Di-n-butyl phthalate	<10	31	<2
08. Fluoranthene	<10	120	<2
09. Fluorene	16	53	<2
10. Hexachlorobenzene	60	<100	<10

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-2 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #2 (Continued)

Detected BDAT List Organic Constituents	Untreated Waste: K019 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Waste: Kiln Ash Concentration mg/kg (ppm)	Treated Waste: Kiln Ash TCLP mg/L (ppm)
SEMIVOLATILES (Continued)				
111. Hexachlorobutadiene	<50	210	<10	
113. Hexachloroethane	85	<100	<10	
121. Naphthalene	314	<20	<2	
126. Nitrobenzene	<25	3,400	<5	
136. Pentachlorobenzene	51	<100	<10	
141. Phenanthrene	15	240	<2	
142. Phenol	<10	78	<2	
145. Pyrene	<10	200	<2	
148. 1,2,4,5-Tetrachlorobenzene	62	<50	<5	
150. 1,2,4-Trichlorobenzene	65	<50	<5	
Detected BDAT List Metal and Inorganic Constituents				
METALS				
154. Antimony	<6.0	24	6.8	<0.06(
155. Arsenic	<0.2	94	2.8	<0.00(
156. Barium	<0.9	1.3	23	0.03(
158. Cadmium	0.46	<0.3	0.96	0.00(
159. Chromium	3.4	40	60	0.13(
160. Copper	1.7	165	3,430	2.38(
161. Lead	2.3	27	42	0.26(
163. Nickel	3.6	8.8	89	0.56(
165. Silver	<0.9	<0.9	3.4	<0.00(
167. Vanadium	<2.0	2.2	4.8	<0.02(
168. Zinc	6.9	4,170	13	0.07
INORGANICS				
169. Total Cyanide	<0.5	0.9	<0.47	
170. Fluoride	<5.0	31	5.1	
171. Sulfide	NA	830	<50	

NA Not Analyzed.

*Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-2 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #2 (Continued)

DESIGN AND OPERATING PARAMETERS

Parameter	Design	Operating Value
Kiln Temperature (°F)	*	1800-1880
Kiln Solids Residence Time (min)	*	120
Waste Feed Rate (MMBTU/hr)	*	K019: 12.2 RCRA Blend, Waste Burner #1: 5.2-5.5 RCRA Blend, Waste Burner #2: 4.4-9.7
Kiln Rotational Speed (RPM)	*	0.19-0.21

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 4-3

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #3

Detected BDAT List Organic Constituents	Untreated Waste: K019 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Waste: Kiln Ash Concentration mg/kg (ppm)
VOLATILES			
4. Benzene	<2,000	2,000	<2
7. Carbon tetrachloride	3,500	<8	<2
9. Chlorobenzene	<2,000	<8	<2
14. Chloroform	5,000	<8	<2
22. 1,1-Dichloroethane	<2,000	<8	<2
23. 1,2-Dichloroethane	87,000	<8	<2
34. Methyl ethyl ketone	<10,000	940	<10
38. Methylene chloride	<10,000	910	<10
42. Tetrachloroethene	6,000	490	<2
43. Toluene	<2,000	2,300	<2
45. 1,1,1-Trichloroethane	34,000	130	<2
47. Trichloroethene	2,200	360	<2
215-217. Xylene (total)	<2,000	3,400	<2
222. Acetone	<10,000	1,200	<10
226. Ethyl benzene	<2,000	2,200	<2
229. Methyl isobutyl ketone	<10,000	1,100	<10
SEMIVOLATILES			
51. Acenaphthalene	<10	150	<2
57. Anthracene	<10	110	<2
65. Benzo(k)fluoranthene	<10	67	<2
68. Bis(2-chloroethyl) ether	290	<20	<2
70. Bis(2-ethylhexyl) phthalate	<10	40	<2
80. Chrysene	SNA	28	<2
87. o-Dichlorobenzene	<10	250	<2
88. p-Dichlorobenzene	80	32	<2
98. Di-n-butyl phthalate	<10	31	<2
108. Fluoranthene	<10	120	<2
109. Fluorene	19	53	<2
110. Hexachlorobenzene	73	<100	<10

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-3 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #3 (Continued)

Detected BDAT List Organic Constituents	Untreated Waste: K019 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Waste: Kiln Ash Concentration mg/kg (ppm)	Treated Waste: Kiln Ash TCLP mg/L (ppm)
SEMIVOLATILES (Continued)				
111. Hexachlorobutadiene	<50	210	<10	
113. Hexachloroethane	95	<100	<10	
121. Naphthalene	350	<20	<2	
126. Nitrobenzene	<25	3,400	<5	
136. Pentachlorobenzene	59	<100	<10	
141. Phenanthrene	11	240	<2	
142. Phenol	<10	78	<2	
145. Pyrene	<10	200	<2	
148. 1,2,4,5-Tetrachlorobenzene	67	<50	5	
150. 1,2,4-Trichlorobenzene	70	<50	<5	
Detected BDAT List Metal and Inorganic Constituents				
METALS				
154. Antimony	<6.0	24	9.2	<0.060
155. Arsenic	<0.2	94	5.7	<0.002
156. Barium	<0.9	1.3	54	0.057
158. Cadmium	0.53	<0.3	3.6	0.005
159. Chromium	3.5	40	202	0.260
160. Copper	1.7	165	2.290	7.030
161. Lead	3.4	27	118	0.620
163. Nickel	2.3	8.8	169	0.960
165. Silver	<0.9	<0.9	1.9	<0.009
167. Vanadium	<2.0	2.2	6.0	<0.020
168. Zinc	4.4	4,170	16	0.170
INORGANICS				
169. Total Cyanide	<0.5	0.9	<0.47	
170. Fluoride	<5.0	31	6.1	
171. Sulfide	NA	830	64	

NA = Not Analyzed.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-3 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #3 (Continued)

DESIGN AND OPERATING PARAMETERS

Parameter	Design	Operating Value
Kiln Temperature (°F)	*	1850-1900
Kiln Solids Residence Time (min)	*	120
Waste Feed Rate (MMBTU/hr)	*	K019: 12.4 RCRA Blend, Waste Burner #1: 5.2-5.8 RCRA Blend, Waste Burner #2: 4.4-8.4
Kiln Rotational Speed (RPM)	*	0.19-0.21

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 4-4

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #4

Detected BDAT List Organic Constituents	Untreated Waste: K019 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Waste: Kiln Ash Concentration mg/kg (ppm)
VOLATILES			
4. Benzene	<2,000	2,000	<2
7. Carbon tetrachloride	3,900	<8	<2
9. Chlorobenzene	<2,000	<8	<2
14. Chloroform	5,300	<8	<2
22. 1,1-Dichloroethane	<2,000	<8	<2
23. 1,2-Dichloroethane	122,000	<8	<2
34. Methyl ethyl ketone	<10,000	940	<10
38. Methylene chloride	<10,000	910	<10
42. Tetrachloroethene	7,200	490	<2
43. Toluene	<2,000	2,300	<2
45. 1,1,1-Trichloroethane	44,000	130	<2
47. Trichloroethene .	2,300	360	<2
215-217. Xylene (total)	<2,000	3,400	<2
222. Acetone	<10,000	1,200	<10
226. Ethyl benzene	<2,000	2,200	<2
229. Methyl isobutyl ketone	<10,000	1,100	<10
SEMIVOLATILES			
51. Acenapnthalene	<10	150	<2
57. Anthracene	<10	110	<2
65. Benzo(k)fluoranthene	<10	67	<2
68. Bis(2-chloroethyl) ether	310	<20	<2
70. Bis(2-ethylhexyl) phthalate	<10	40	12
80. Chrysene	SNA	28	<2
87. o-Dichlorobenzene	<10	250	<2
88. p-Dichlorobenzene	84	32	<2
98. Di-n-butyl phthalate	<10	31	230
108. Fluoranthene	<10	120	<2
109. Fluorene	21	53	<2
110. Hexachlorobenzene	61	<100	<10

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.

*Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-4 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #4 (Continued)

	Untreated Waste		Treated Waste	
	K019 Concentration	RCRA Blend* Concentration	Kiln Asn Concentration	Kiln Asn TCLP
Detected BDAT List Organic Constituents	mg/kg (ppm)	mg/kg (ppm)	mg/kg (ppm)	mg/L (ppm)
SEMIVOLATILES (Continued)				
111. Hexachlorobutadiene	<50	210	<10	
113. Hexachloroethane	94	<100	<10	
121. Naphthalene	360	<20	<2	
126. Nitrobenzene	<25	3,400	<5	
136. Pentachlorobenzene	64	<100	<10	
141. Phenanthrene	19	240	<2	
142. Phenol	<10	78	<2	
145. Pyrene	<10	200	<2	
148. 1,2,4,5-Tetrachlorobenzene	82	<50	<5	
150. 1,2,4-Trichlorobenzene	74	<50	<5	
Detected BDAT List Metal and Inorganic Constituents				
METALS				
154. Antimony	<6.0	24	<6.0	<0.060
155. Arsenic	<0.2	94	5.7	<0.002
156. Barium	<0.9	1.3	8.4	0.036
158. Cadmium	<0.3	<0.3	<0.3	0.005
159. Chromium	1.8	40	28	0.110
160. Copper	<1.0	165	1,270	1.940
161. Lead	2.4	27	25	0.320
163. Nickel	2.2	8.8	69	0.870
165. Silver	<0.9	<0.9	2.6	<0.009
167. Vanadium	<2.0	2.2	<2.0	<0.020
168. Zinc	9.4	4,170	11	0.056
INORGANICS				
169. Total Cyanide	<0.5	0.9	<0.47	
170. Fluoride	<5.0	31	3.2	
171. Sulfide	NA	830	<50	

NA = Not Analyzed.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-4 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #4 (Continued)

DESIGN AND OPERATING PARAMETERS

Parameter	Design	Operating Value
Kiln Temperature (^{o}F)	*	1775-1900
Kiln Solids Residence Time (min)	*	120
Waste Feed Rate (MMBTU/hr)	*	K019: 12.7 RCRA Blend, Waste Burner #1: 5.2-5.8 RCRA Blend, Waste Burner #2: 4.4-7.3
Kiln Rotational Speed (RPM)	*	0.19-0.21

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 4-5

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #5

Detected BDAT List Organic Constituents	Untreated Waste: K019 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Waste: Kiln Asn Concentration mg/kg (ppm)
VOLATILES			
4. Benzene	<2,000	2,000	<2
7. Carbon tetrachloride	4,000	<8	<2
9. Chlorobenzene	<2,000	<8	<2
14. Chloroform	6,000	<8	<2
22. 1,1-Dichloroethane	<2,000	<8	<2
23. 1,2-Dichloroethane	130,000	<8	<2
34. Methyl ethyl ketone	<10,000	940	<10
38. Methylene chloride	<10,000	910	<10
42. Tetrachloroethene	7,800	490	<2
43. Toluene	<2,000	2,300	<2
45. 1,1,1-Trichloroethane	45,000	130	<2
47. Trichloroethene	2,500	360	<2
215-217. Xylene (total)	<2,000	3,400	<2
222. Acetone	<10,000	1,200	<10
226. Ethyl benzene	<2,000	2,200	<2
229. Methyl isobutyl ketone	<10,000	1,100	<10
SEMIVOLATILES			
51. Acenapnthalene	<10	150	<2
57. Anthracene	<10	110	<2
65. Benzo(k)fluoranthene	<10	67	<2
68. Bis(2-chloroethyl) ether	340	<20	<2
70. Bis(2-ethylhexyl) phthalate	<10	40	<2
80. Chrysene	SNA	28	<2
87. o-Dichlorobenzene	<10	250	<2
88. p-Dichlorobenzene	90	32	<2
98. Di-n-butyl phthalate	<10	31	<2
108. Fluoranthene	<10	120	<2
109. Fluorene	19	53	<2
110. Hexachlorobenzene	87	<100	<10

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-5 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #5 (Continued)

	Untreated Waste		Treated Waste	
	K019 Concentration	RCRA Blend* Concentration	Kiln Asn Concentration	Kiln Asn TCLP
Detected BDAT List Organic Constituents	mg/kg (ppm)	mg/kg (ppm)	mg/kg (ppm)	mg/L (ppm)
SEMIVOLATILES (Continued)				
111. Hexachlorobutadiene	<50	210	<10	
113. Hexachloroethane	113	<100	<10	
121. Naphthalene	371	<20	<2	
126. Nitrobenzene	<25	3,400	<5	
136. Pentachlorobenzene	63	<100	<10	
141. Phenanthrene	19	240	<2	
142. Phenol	<10	78	<2	
145. Pyrene	<10	200	<2	
148. 1,2,4,5-Tetrachlorobenzene	73	<50	<5	
150. 1,2,4-Trichlorobenzene	72	<50	<5	
Detected BDAT List Metal and Inorganic Constituents				
METALS				
154. Antimony	<6.0	24	9.1	<0.060
155. Arsenic	<0.2	94	3.9	<0.002
156. Barium	<0.9	1.3	21	0.054
158. Cadmium	0.36	<0.3	1.2	0.006
159. Chromium	3.2	40	125	0.210
160. Copper	2.1	165	2,780	2.140
161. Lead	2.5	27	86	0.290
163. Nickel	4.8	8.8	166	1.270
165. Silver	<0.9	<0.9	3.3	<0.009
167. Vanadium	<2.0	2.2	5.7	<0.020
168. Zinc	4.7	4,170	22	0.086
INORGANICS				
169. Total Cyanide	<0.5	0.9	<0.47	
170. Fluoride	<5.0	31	23	
171. Sulfide	NA	830	64	

NA = Not Analyzed.

*Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-5 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #5 (Continued)

DESIGN AND OPERATING PARAMETERS

Parameter	Design	Operating Value
Kiln Temperature (°F)	*	1775-1800
Kiln Solids Residence Time (min)	*	120
Waste Feed Rate (MMBTU/hr)	*	K019: 11.7 RCRA Blend, Waste Burner #1: 5.5-6.0 RCRA Blend, Waste Burner #2: 5.2-9.7
Kiln Rotational Speed (RPM)	*	0.19-0.21

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 4-6

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #6

Detected BDAT List Organic Constituents	Untreated Waste: K019 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Waste: Kiln Ash Concentration mg/kg (ppm)
VOLATILES			
4. Benzene	<2,000	2,000	<2
7. Carbon tetrachloride	4,100	<8	<2
9. Chlorobenzene	<2,000	<8	<2
14. Chloroform	5,600	<8	<2
22. 1,1-Dichloroethane	<2,000	<8	<2
23. 1,2-Dichloroethane	98,000	<8	<2
34. Methyl ethyl ketone	<10,000	940	<10
38. Methylene chloride	<10,000	910	<10
42. Tetrachloroethene	6,900	490	<2
43. Toluene	<2,000	2,300	<2
45. 1,1,1-Trichloroethane	44,000	130	<2
47. Trichloroethene	2,500	360	<2
215-217. Xylene (total)	<2,000	3,400	<2
222. Acetone	<10,000	1,200	<10
226. Ethyl benzene	<2,000	2,200	<2
229. Methyl isobutyl ketone	<10,000	1,100	<10
SEMIVOLATILES			
51. Acenapthalene	<10	150	<2
57. Anthracene	<10	110	<2
65. Benzo(k)fluoranthene	<10	67	<2
68. Bis(2-chloroethyl) ether	330	<20	<2
70. Bis(2-ethylhexyl) phthalate	<10	40	<2
80. Chrysene	SNA	28	<2
87. o-Dichlorobenzene	<10	250	<2
88. p-Dichlorobenzene	90	32	<2
98. Di-n-butyl phthalate	<10	31	<2
108. Fluoranthene	<10	120	<2
109. Fluorene	22	53	<2
110. Hexachlorobenzene	66	<100	<10

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-6 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #6 (Continued)

Detected BDAT List Organic Constituents	Untreated Waste: K019 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Waste: Kiln Asn Concentration mg/kg (ppm)	Treated Waste: Kiln Asn TCLP mg/L (ppm)
SEMIVOLATILES (Continued)				
111. Hexachlorobutadiene	<50	210	<10	
113. Hexachloroethane	88	<100	<10	
121. Naphthalene	390	<20	<2	
126. Nitrobenzene	<25	3,400	<5	
136. Pentachlorobenzene	65	<100	<10	
141. Phenanthrene	17	240	<2	
142. Phenol	<10	78	<2	
145. Pyrene	<10	200	<2	
148. 1,2,4,5-Tetrachlorobenzene	86	<50	<5	
150. 1,2,4-Trichloroenzene	79	<50	<5	
Detected BDAT List Metal and Inorganic Constituents				
METALS				
154. Antimony	<6.0	24	9.6	< 0.06
155. Arsenic	<0.2	94	2.3	<0.002
156. Barium	<0.9	1.3	11	0.027
158. Cadmium	0.62	<0.3	2.2	0.006
159. Chromium	5.3	40	141	0.092
160. Copper	3.6	165	2,520	2.400
161. Lead	3.5	27	34	0.270
163. Nickel	6.0	8.8	288	0.690
165. Silver	<0.9	<0.9	3.1	<0.009
167. Vanadium	<2.0	2.2	8.7	<0.020
168. Zinc	8.4	4,170	13	0.061
INORGANICS				
169. Total Cyanide	<0.5	0.9	<0.47	
170. Fluoride	<5.0	31	4.7	
171. Sulfide	NA	830	92	

NA = Not Analyzed.

*Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-6 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #6 (Continued)

DESIGN AND OPERATING PARAMETERS

Parameter	Design	Operating Value
Kiln Temperature (°F)	*	1775-1850
Kiln Solids Residence Time (min)	*	120
Waste Feed Rate (MMBTU/hr)	*	K019: 11.5 RCRA Blend, Waste Burner #1: 5.2-5.8 RCRA Blend, Waste Burner #2: 5.2-9.7
Kiln Rotational Speed (RPM)	*	0.19-0.21

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 4-7

WASTEWATER TREATMENT PERFORMANCE DATA
FOR CHLOROFORM

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Full	1607B		0-100	3	9.000		90.1	WERL
AL	Full	1B		100-1000	6	26.000		96.8	WERL
AL	Pilot	203A		100-1000	14	53.000		61	WERL
AL	Full	141A		100-1000		16.000		92.3	WERL
AL	Full	1607B		100-1000	2	10.000		97.4	WERL
AL	Full	1607B		100-1000	3	130.000		86	WERL
AL	Pilot	203A		100-1000	14	31.000		77	WERL
AS	Full	1B		0-100	3	20.000		80	WERL
AS	Full	6B		100-1000	7	30.000		77	WERL
AS	Full	1B		0-100	5	6.000		86	WERL
AS	Full	6B		100-1000	3	10.000		97.7	WERL
AS	Bench	202D		10000-100000		200.000		99.43	WERL
AS	Full	234A		0-100		1.200		61	WERL
AS	Full	1B		0-100	6	21.000		62	WERL
AS	Full	375E		0-100	7	1.000		75	WERL
AS	Full	1B		100-1000	6	59.000		51	WERL
AS	Full	975B		0-100		2.000		93.8	WERL
AS	Full	234A		0-100		2.300		72	WERL
AS	Full	234A		0-100		0.500		98.4	WERL
AS	Full	6B		100-1000	3	10.000		98.2	WERL
AS	Full	238A		0-100	3	2.400		46	WERL
AS	Full	1607B		100-1000	3	50.000		86	WERL
AS	Full	1607B		1000-10000	2	40.000		96.9	WERL
AS	Pilot	206B		100-1000	20	3.600		97.4	WERL
AS	Full	375E		0-100	7	20.000		78	WERL
AS	Full	1587E		0-100		1.600		65	WERL
AS	Pilot	241B		100-1000	5	44.000		85	WERL
AS	Full	234A		0-100		1.300		84	WERL
AS	Pilot	203A		100-1000	14	18.000		87	WERL
AS	Full	6B		1000-10000	27	19.000		98.7	WERL
AS	Full	201B		0-100	29	38.000		53	WERL
AS	Full	234A		0-100		1.300		65	WERL
AS	Pilot	240A		0-100	14	2.000		98	WERL
AS+Fil	Full	6B		1000-10000	3	10.000		99.41	WERL
AS+Fil	Full	6B		100-1000	14	10.000		95.8	WERL
AirS	Bench	1328E		100000-1000000	5	16000.000		93.1	WERL
AirS	Pilot	369A		0-100		1.400		98.2	WERL
AirS	Pilot	213B		0-100	1	13.000		77	WERL
AirS	Bench	1328E		10000-100000	5	4400.000		83	WERL

Table 4-7 (Continued)

WASTEWATER TREATMENT PERFORMANCE DATA FOR CHLOROFORM

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AirS	Pilot	225B		0-100	1	0.130		98.9	WERL
AirS	Bench	17A		0-100		2.600		96.9	WERL
AirS	Bench	17A		1000-10000		110.000		91.7	WERL
AirS	Bench	17A		0-100		3.900		88	WERL
AirS	Bench	17A		100-1000		4.200		98.6	WERL
AirS	Pilot	210B		100-1000	1	1.000		99.2	WERL
AirS	Bench	17A		100-1000		3.700		98.6	WERL
AirS	Bench	1328E		100-1000	5	34.000		84	WERL
AirS	Pilot	434B		1000-10000	4	41.000		98	WERL
CAC	Pilot	203A		100-1000	14	106.000		22	WERL
CAC+AirS	Full	1833D		0-100	25	0.200		89	WERL
ChOx	Bench	640E		100-1000	2	7.000		96	WERL
ChOx	Bench	640E		100-1000	1	3.000		99	WERL
ChOx (Oz)	Pilot	331D		0-100		46.000		37	WERL
ChOx (Oz)	Pilot	331D		0-100		2.800		35	WERL
GAC	Full	1264B		0-100		1.000		87	WERL
GAC	Pilot	331D		0-100		1.000		98.6	WERL
GAC	Full	245B		100-1000	1	10.000		97.6	WERL
GAC	Full	237A		100-1000	1	10.000		98.1	WERL
GAC	Full	245B		100-1000	1	10.000		96.2	WERL
PACT	Bench	242E		0-100		20.000		47	WERL
PACT	Bench	Zimpro		1470	1	1.000		99.9	WAO
PACT	Bench	Zimpro		38	1	20.000		47	WAO
RO	Pilot	180A		0-100		0.890		71	WERL
RO	Full	250B		1000-10000		110.000		94.5	WERL
RO	Full	250B		100-1000		53.000		87	WERL
SCOx	Pilot	65D		100-1000		1.700		99.83	WERL
SS	Full	415T	10	7330-1088000	15	10.500			ITD-L
SS	Full	913	10	28700-200000	14	129.200			ITD-L
SS	Full	6B		100000-1000000	15	10.000		99.99	WERL
SS	Full	6B		10000-100000	2	120.000		99.88	WERL
SS	Full	251B		1000000	10	6000.000		99.99	WERL
SS	Full	251B		100000-1000000	10	9600.000		96.4	WERL
TF	Pilot	240A		0-100	14	11.000		89	WERL
TF	Full	1B		0-100	4	14.000		86	WERL
TF	Pilot	203A		100-1000	14	102.000		24	WERL
WOx	Bench	Zimpro		4450000	1	3000.000		99.9	WAO
WOx	Bench	Zimpro		270000	1	1000.000		99	WAO

Table 4-8

WASTEWATER TREATMENT PERFORMANCE DATA
FOR 1,2-DICHLOROETHANE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Pilot	203A		100-1000	14	15.000		90.2	WERL
AL	Full	1B		1000-10000	6	10.000		99.75	WERL
AL	Pilot	203A		100-1000	14	45.000		71	WERL
AL+AS	Full	233D		1000-10000	21	8.000		99.67	WERL
AS	Pilot	203A		100-1000	14	22.000		86	WERL
AS	Pilot	241B		100-1000	3	140.000		57	WERL
AS	Full	1B		1000-10000	6	4400.000		33	WERL
AS	Full	6B		100-1000	3	12.000		98.1	WERL
AS	Pilot	240A		0-100	13	5.000		94.3	WERL
AS	Full	6B		1000-10000	25	29.000		98.6	WERL
AS	Full	375E		100-1000	7	74.000		82	WERL
AS	Bench	202D		100000-1000000		3700.000		98.6	WERL
AS	Full	1B		10000-100000	6	1800.000		89	WERL
AS	Full	6B		100-1000	13	94.000		84	WERL
AS	Full	6B		100-1000	12	15.000		98.5	WERL
AS+Fil	Full	6B		10000-100000	3	1200.000		98.5	WERL
AirS	Full	322B		100-1000	5	55.000		89	WERL
AirS	Full	322B		1000-10000	5	189.000		91.8	WERL
CAC	Pilot	203A		100-1000	14	109.000		29	WERL
PACT	Bench	Zimpro		210	1	1.000		99.5	WAO
RO	Full	250B		1000-10000		350.000		84	WERL
RO	Full	250B		0-100		13.000		79	WERL
RO	Pilot	323B		0-100	1	32.000		37	WERL
RO	Full	250B		100-1000		43.000		76	WERL
SS	Full	415T	10	2339900-2347600	15	56.100			ITD-L
SS	Full	913	10	172000-327000	14	73.300			ITD-L
SS	Full	251B		1000000	10	97.000		99.99	WERL
SS	Full	6B		1000000	15	56.000		99.99	WERL
SS	Full	6B		100000-1000000	2	50.000		99.98	WERL
TF	Pilot	240A		0-100	13	12.000		86	WERL
TF	Full	375E		100-1000	7	45.000		65	WERL
TF	Pilot	203A		100-1000	14	93.000		39	WERL
WOx	Bench	Zimpro		6280000	1	13000.000		99.8	WAO
WOx (B)	Bench	1054E		1000000		230000.000		93.6	WERL

Table 4-9

WASTEWATER TREATMENT PERFORMANCE DATA
FOR 1,1-DICHLOROETHYLENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Pilot	203A		100-1000	14	83.000		61	WERL
AL	Pilot	203A		100-1000	14	35.000		84	WERL
AS	Full	6B		100-1000	3	10.000		97.2	WERL
AS	Pilot	206B		0-100	20	0.200		99.75	WERL
AS	Full	201B		0-100	2	1.000		97.5	WERL
AS	Pilot	203A		100-1000	14	14.000		93.4	WERL
AS	Full	1B		0-100	2	5.000		86	WERL
AS	Full	6B		100-1000	22	10.000		97	WERL
AS	Full	1B		0-100	2	6.000		92.9	WERL
AS	Pilot	240A		0-100	12	1.000		98.3	WERL
AS	Full	6B		100-1000	3	25.000		97	WERL
AirS	Pilot	217B		0-100	1	0.300		95.6	WERL
AirS	Pilot	222B		0-100	1	1.000		92.3	WERL
AirS	Pilot	1362E		1000-10000	3	4.000		99.82	WERL
AirS	Full	1344E		1000-10000		2.000		99.94	WERL
AirS	Pilot	1139E		100-1000	6	7.400		92.7	WERL
AirS	Pilot	1139E		0-100	2	1.000		98.6	WERL
CAC	Pilot	203A		100-1000	14	150.000		29	WERL
GAC	Full	237A		0-100	1	10.000		64	WERL
GAC	Full	1264B		0-100		1.000		70	WERL
GAC	Pilot	1139E		0-100		1.000		97	WERL
RO	Full	250B		0-100		1.200		98.4	WERL
RO	Full	250B		0-100		3.100		72	WERL
RO	Full	250B		1000-10000		240.000		78	WERL
SS	Full	251B		1000-10000	10	10.000		99.79	WERL
SS	Full	6B		1000-10000	2	10.000		99.87	WERL
SS	Full	6B		1000-10000	15	10.000		99.77	WERL
SS	Full	415T	10	200-10800	15	10.200			ITD-L
SS	Full	913	10	2900-12300	14	10.000			ITD-L
TF	Pilot	240A		0-100	12	1.000		98.3	WERL
TF	Pilot	203A		100-1000	14	85.000		60	WERL

Table 4-10

WASTEWATER TREATMENT PERFORMANCE DATA
FOR METHYLENE CHLORIDE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AS	Full	1B		0-100	3	23.000		64	WERL
AS	Full	1B		0-100	3	17.000		72	WERL
AS	Full	1B		0-100	4	31.000		31	WERL
AS	Full	234A		0-100		2.000		93.3	WERL
AS	Full	201B		0-100	27	45.000		51	WERL
AS	Full	975B		0-100		0.430		92	WERL
AS	Full	1B		0-100	3	9.000		75	WERL
AS	Full	1B		100-1000	6	46.000		69	WERL
AS	Full	1B		100-1000	6	130.000		54	WERL
AS	Full	1B		0-100	4	23.000		57	WERL
AS	Full	6B		0-100	3	10.000		77	WERL
AS	Full	1B		0-100	4	61.000		34	WERL
AS	Full	238A		0-100	3	11.000		78	WERL
AS	Full	234A		0-100		4.900		56	WERL
AS	Bench	202D		100000-1000000		510.000		99.72	WERL
AS	Full	375E		0-100	7	10.000		69	WERL
AS	Full	6B		1000-10000	40	54.000		98.6	WERL
AS	Full	1B		0-100	5	16.000		72	WERL
AS	Full	6B		1000-10000	10	31.000		99.53	WERL
AS	Full	1B		0-100	3	23.000		74	WERL
AS	Full	6B		1000-10000	3	10.000		99.74	WERL
AS	Full	1B		0-100	6	17.000		77	WERL
AS	Full	1B		1000-10000	5	56.000		97.8	WERL
AS	Full	6B		0-100	10	13.000		79	WERL
AS	Full	1B		100-1000	5	560.000		31	WERL
AS	Pilot	206B		100-1000	20	4.000		96.6	WERL
AS	Full	1168E		10000-100000		920.000		98.4	WERL
AS	Full	234A		100-1000		0.800		99.5	WERL
AS	Full	1B		10000-100000	5	12000.000		14	WERL
AS	Full	1B		0-100	4	17.000		64	WERL
AS	Pilot	241B		100-1000	5	110.000		78	WERL
AS	Full	375E		0-100	7	5.000		80	WERL
AS	Full	1B		0-100	6	61.000		34	WERL
AS	Full	375E		1000-10000	7	55.000		99.3	WERL
AS	Full	1B		1000-10000	5	2000.000		5	WERL
AS	Full	1B		0-100	5	62.000		35	WERL
AS	Full	375E		0-100	7	20.000		64	WERL
AS+Fil	Full	6B		0-100	9	29.000		26	WERL
AirS	Pilot	205E		100-1000		3.000		99.6	WERL
AirS	Pilot	1362E		100-1000	3	5.300		99	WERL
AirS+GAC	Full	229A		100-1000	19	1.000		99.8	WERL

Table 4-10 (Continued)
WASTEWATER TREATMENT PERFORMANCE DATA
FOR METHYLENE CHLORIDE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
BT	Full	P246		27-3907	13	11.000			BDAT #
BT	Full	P265		500-750	3	27.000			BDAT #
BT+AC	Full	P246		10-5550	28	10.000			BDAT #
CAC+Airs	Full	1833D		0-100	25	2.400		92.3	WERL
GAC	Full	245B		100-1000	1	10.000		99	WERL
GAC	Full	237A		100-1000	1	10.000		94.4	WERL
PACT	Bench	242E		0-100		20.000		76	WERL
PACT	Bench	Zimpro		84	1	20.000		76	WAO
RO	Full	250B		100-1000		80.000		66	WERL
RO	Full	250B		10000-100000		15000.000		44	WERL
SS	Full	725	10	10-5100	13	217.300			ITD-L
SS	Full	913	10	200-10400	14	10.000			ITD-L
SS	Full	415T	10	198-12100	15	10.500			ITD-L
SS	Full	6B		1000-10000	15	10.000		99.52	WERL
SS	Full	251B		1000-10000	10	10.000		99.17	WERL
SS	Full	251B		1000000	10	11.000		100	WERL
SS	Full	6B		1000-10000	9	78.000		95.1	WERL
SS	Full	P12003		225000-12000000	40	24413.000			BDAT #
SS	Full	6B		100-1000	2	10.000		99	WERL
SS	Full	P284		198-12100	15	10.000			BDAT #
TF	Full	1B		0-100	5	20.000		67	WERL
TF	Full	375E		0-100	7	12.000		8	WERL
TF	Full	1B		0-100	3	23.000		36	WERL
TF	Full	1B		0-100	5	58.000		40	WERL
TF	Full	1B		0-100	5	21.000		77	WERL
TF	Full	1B		100-1000	6	16.000		89	WERL
TF	Full	1B		100-1000	4	120.000		56	WERL
TF	Full	375E		100-1000	7	21.000		88	WERL
TF	Full	1B		100-1000	5	37.000		66	WERL
WOx		REF10		15000-3600000	3	5000.000			BDAT #
WOx	Pilot	Zimpro		60000	1	10.000		99.9	WAO
WOx	Pilot	78D		10-100		10.000		99.98	WERL
WOx	Full	242E		100000-1000000		84.000		99.99	WERL

ITD data presented in the BDAT Solvents Rule F001-F005 Background Document.

Table 4-11

WASTEWATER TREATMENT PERFORMANCE DATA
FOR CARBON TETRACHLORIDE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Pilot	203A		0-100	14	11.000		84	WERL
AL	Pilot	203A		0-100	14	15.000		78	WERL
AS	Pilot	203A		0-100	14	13.000		81	WERL
AS	Full	1B		100-1000	6	16.000		88	WERL
AS	Pilot	206B		0-100	20	0.200		99.67	WERL
AS	Full	975B		0-100		3.000		94.8	WERL
AS	Bench	202D		10000-100000		130.000		99.32	WERL
AS	Full	6B		100-1000	3	10.000		96.7	WERL
AS	Pilot	241B		100-1000	5	5.000		98.3	WERL
AS	Pilot	240A		0-100	12	4.000		90.7	WERL
AS+Fil	Full	6B		1000-10000	14	10.000		99.09	WERL
AS+Fil	Full	6B		10000-100000	2	10.000		99.96	WERL
AirS	Bench	1328E		10000-100000	5	7600.000		89	WERL
BT	Full	P225		51-44000	17	10.000			BDAT #
BT	Full	REF4		95	1	5.500			BDAT #
CAC	Pilot	203A		100-1000	14	101.000		0	WERL
GAC	Full	1264B		0-100		1.000		87	WERL
GAC	Full	237A		0-100	1	10.000		89	WERL
PACT	Bench	242E		1000-10000		30.000		98.5	WERL
PACT	Bench	Zimpro		860	1	1.000		99.9	WAO
PACT	Bench	Zimpro		2000	1	30.000		98.5	WAO
RO	Pilot	323B		100-1000	1	2.000		98	WERL
SCOx	Pilot	65D		100-1000		20.000		96.5	WERL
SS	Full	251B		10000-100000	10	5.000		99.99	WERL
SS	Full	251B		1000-10000	10	10.000		99.41	WERL
TF	Pilot	203A		0-100	14	26.000		62	WERL
TF	Pilot	240A		0-100	12	4.000		90.7	WERL
WOx	Bench	Zimpro		4330000	1	12000.000		99.7	WAO
WOx	Full	242E		1000000		2000.000		99.92	WERL

ITD data presented in the BDAT Solvents Rule F001-F005 Background Document.

Table 4-12

WASTEWATER TREATMENT PERFORMANCE DATA
FOR 1,1,2-TRICHLOROETHANE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AS	Full	6B		100-1000	3	18.000		97.1	WERL
AS	Pilot	206B		100-1000	20	28.000		79	WERL
AS	Full	6B		0-100	3	10.000		60	WERL
AS	Full	1B		0-100	3	5.000		88	WERL
AS	Pilot	241B		100-1000	5	110.000		54	WERL
PACT	Bench	242E		0-100		5.000		83	WERL
PACT	Bench	190E		1000-10000		4.200		99.68	WERL
PACT	Bench	Zimpro		30	1	5.000		83	WAO
SCOx	Pilot	65D		100000-1000000		36.000		99.98	WERL
SS	Full	913	10	416-26400	14	11.200			ITD-1
SS	Full	415T	10	220-14500	15	10.000			ITD-1
SS	Full	6B		10000-100000	2	10.000		99.96	WERL
SS	Full	6B		1000-10000	8	10.000		99.85	WERL
SS	Full	251B		1000-10000	10	10.000		99.87	WERL
SS	Full	251B		1000-10000	10	5.000		99.91	WERL
WOx	Full	242E		10000-100000		30.000		99.91	WERL

Table 4-13

WASTEWATER TREATMENT PERFORMANCE DATA
FOR TRICHLOROETHENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AS	Bench	202D		10000-100000		210.000		99.78	WERL
AS	Full	1B		0-100	4	5.000		89	WERL
AS	Full	1B		100-1000	6	2.000		99.23	WERL
AS	Full	6B		100-1000	3	10.000		94.1	WERL
AS	Full	1587E		0-100		0.100		95.7	WERL
AS	Full	375E		0-100	7	2.500		58	WERL
AS	Full	1B		0-100	6	1.000		96.7	WERL
AS	Pilot	206B		100-1000	20	1.500		98.6	WERL
AS	Full	238A		0-100	3	2.100		90.6	WERL
AS	Full	1B		100-1000	4	3.000		97.3	WERL
AS	Pilot	241B		100-1000	5	7.000		96.7	WERL
AS	Full	1B		100-1000	6	64.000		87	WERL
AS	Full	234A		0-100		0.700		71	WERL
AS	Full	201B		0-100	6	13.000		87	WERL
AS	Full	1B		0-100	6	2.000		97.6	WERL
AS	Full	1B		0-100	5	1.000		98.5	WERL
AS	Full	6B		0-100	5	10.000		89	WERL
AS	Full	238A		0-100	3	0.500		94.8	WERL
AS	Full	234A		0-100		0.700		92.3	WERL
AS	Full	1B		100-1000	5	31.000		74	WERL
AS	Full	1B		100-1000	6	87.000		87	WERL
AS	Full	1B		0-100	4	4.000		89.7	WERL
AS	Full	1B		100-1000	6	37.000		92.6	WERL
AS	Full	1B		0-100	5	16.000		72	WERL
AirS	Pilot	1362E		1000-10000	3	1.000		99.94	WERL
AirS	Pilot	209B		100-1000	1	0.800		99.58	WERL
AirS	Full	199B		100-1000		1.500		99.75	WERL
AirS	Pilot	26A		100-1000		27.000		87	WERL
AirS	Pilot	216B		100-1000	1	2.100		98.9	WERL
AirS	Pilot	219B		100-1000	1	0.500		99.58	WERL

Table 4-13 (Continued)

WASTEWATER TREATMENT PERFORMANCE DATA
FOR TRICHLOROETHENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AirS	Pilot	369A		0-100		0.300		99.44	WERL
AirS	Pilot	211B		100-1000	1	3.100		98.6	WERL
AirS	Pilot	205E		0-100		1.000		97.2	WERL
AirS	Pilot	220B		100-1000	1	0.200		99.92	WERL
AirS	Pilot	217B		100-1000	1	1.200		99.69	WERL
AirS	Full	322B		100-1000	10	0.460		99.91	WERL
AirS	Pilot	1327E		1000-10000		190.000		91.3	WERL
AirS	Pilot	212B		0-100	1	0.400		99.6	WERL
AirS	Full	223B		0-100	1	0.500		98.2	WERL
AirS	Full	69A		0-100		1.400		98.1	WERL
AirS	Pilot	369A		0-100		3.000		93.2	WERL
AirS	Pilot	221B		0-100	1	0.500		99.44	WERL
AirS	Pilot	1585E		0-100	1	4.300		87	WERL
AirS	Pilot	1363E		100-1000		5.000		97.1	WERL
AirS	Pilot	1327E		0-100		4.300		87	WERL
AirS	Pilot	211B		1000-10000	1	7.700		99.3	WERL
AirS	Full	1042E		0-100		0.300		99.68	WERL
AirS	Pilot	215B		0-100	1	0.500		98	WERL
AirS	Pilot	208B		0-100	1	0.700		99.03	WERL
AirS	Pilot	222B		0-100	1	0.300		99.21	WERL
AirS	Full	322B		1000-10000	7	11.000		99.77	WERL
AirS	Pilot	1585E		1000-10000	1	170.000		84	WERL
AirS	Pilot	71D		100-1000	1	5.000		98.5	WERL
AirS	Pilot	207B		0-100	1	0.500		98.7	WERL
BT	Full	REF4		60	1	5.800			BDAT #
BT	Full	P213		16-76	3	10.000			BDAT #
BT	Full	P217		98-224	3	10.000			BDAT #
BT	Full	P253		484	1	16.000			BDAT #
BT+AC	Full	P246		40-70	3	10.000			BDAT #
CAC+AirS	Full	1833D		0-100	20	0.200		90	WERL
ChOx	Pilot	2026A		0-100	4	3.700		96.2	WERL

ITD data presented in the BDAT Solvents Rule F001-F005 Background Document.

Table 4-13 (Continued)
WASTEWATER TREATMENT PERFORMANCE DATA
FOR TRICHLOROETHENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
ChOx	Pilot	2026A		100-1000		7.100		94.4	WERL
Chred	Pilot			200	1	5.000			ART
Chred	Bench			280	1	3.900			ART
Chred	Bench			300	1	0.400			ART
GAC	Full	1264B		100-1000		1.000		99.36	WERL
GAC	Full	1264B		0-100		1.000		98.8	WERL
GAC	Full	245B		100-1000	1	10.000		97.8	WERL
GAC	Full	1264B		0-100		1.300		98.6	WERL
GAC	Full	245B		1000-10000	1	10.000		99.46	WERL
GAC	Full	237A		100-1000	1	10.000		95.8	WERL
GAC	Pilot	REF8		171	1	0.590			BDAT #
PACT	Bench	242E		0-100		10.000		89	WERL
PACT	Bench	Zimpro		326	1	1.000		99.7	WAO
PACT	Bench	Zimpro		90	1	10.000		89	WAO
PACT	Bench	Zimpro		32.8	1	0.005		99.98	WAO
RO	Full	250B		100-1000		110.000		78	WERL
RO	Full	250B		0-100		5.500		79	WERL
RO	Pilot	323B		0-100	1	68.000		30	WERL
SS	Full	415	10	59-10300	15	16.100			ITD-L
SS	Full	251B		1000-10000	10	5.000		99.91	WERL
SS	Full	6B		1000-10000	14	16.000		99.20	WERL
SS	Full	6B		10000-100000	2	10.000		99.97	WERL
SS	Full	251B		1000-10000	10	10.000		99.79	WERL
SS	Full	913	10	22900-52700	14	10.000			ITD-L
SS	Full	P284		10-10300	15	16.000			BDAT #
TF	Full	1B		0-100	6	1.000		98.8	WERL
TF	Full	1B		100-1000	5	1.000		99.33	WERL
TF	Full	1B		0-100	5	1.000		98.5	WERL
TF	Full	1B		0-100	5	1.000		98.4	WERL
TF	Full	1B		0-100	6	5.000		93.2	WERL
UV [B]	Bench	1138E		0-100		22.000		56	WERL
WOx	Bench	Zimpro		500000	1	1700.000		99.7	WAO
WOx	Bench	Zimpro		300000	1	2000.000		99.3	WAO
WOx [B]	Bench	78D		100000-1000000		1700.000		99.66	WERL

ITD data presented in the BDAT Solvents Rule F001-F005 Background Document.

Table 4-14

WASTEWATER TREATMENT PERFORMANCE DATA
FOR VINYL CHLORIDE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AS	Full	6B		100-1000	3	50.000		94.9	WERL
AS	Full	1B		1000-10000	6	100.000		94.1	WERL
AS	Full	1B		0-100	4	20.000		80	WERL
AS	Full	1B		10000-100000	6	3900.000		92.9	WERL
AS+Fil	Full	6B		1000-10000	14	50.000		98.3	WERL
AirS	Pilot	217B		0-100	1	0.500		93.1	WERL
AirS	Full	1344E		100-1000		0.100		99.99	WERL
AirS	Full	69A		0-100		0.300		96.4	WERL
SS	Full	251B		1000-10000	10	10.000		99.88	WERL
SS	Full	913	50	50-3500	14	50.000			ITD-1
SS	Full	725	50	410000-2230000	13	37944.200			ITD-1
SS	Full	6B		1000000	11	120.000		99.99	WERL

Table 4-15

WASTEWATER TREATMENT PERFORMANCE DATA
FOR HEXACHLOROETHANE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AS	Pilot	241B		100-1000	11	10.000		97.1	WERL
AS+Fil	Full	6B		100-1000	14	10.000		93.8	WERL

Table 4-16

WASTEWATER TREATMENT PERFORMANCE DATA
FOR HEXACHLOROBENZENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AS	Full	375E		0-100	7	0.010		83	WERL
AS	Full	375E		0-100	7	0.010		94.4	WERL
AS+Fil	Full	6B		100-1000	14	10.000		96.7	WERL
GAC	Full	237A		0-100	1	20.000		38	WERL

Table 4-17

WASTEWATER TREATMENT PERFORMANCE DATA
FOR HEXACHLOROBUTADIENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AS	Pilot	241B		100-1000	11	15.000		96.2	WERL
AS+Fil	Full	6B		100-1000	2	10.000		92.8	WERL
AS+Fil	Full	6B		1000-10000	14	10.000		99.6	WERL
GAC	Full	237A		100-1000	1	20.000		82	WERL

5. IDENTIFICATION OF BEST DEMONSTRATED AVAILABLE TECHNOLOGY

This section contains the determination of BDAT for the nonwastewater and wastewater forms of F025 wastes. The Agency believes that the F025 constituents listed in Tables 1-1 through 1-4 can be present in both nonwastewater and wastewater forms. The nonwastewater streams may include the raw waste as generated, the ash residual after incineration, the residuals from treatment of incinerator scrubber wastewaters, or residuals from other types of demonstrated treatment technologies (identified in Section 3). The wastewater residuals may be the raw waste as generated, combustion gas scrubber water from incineration, or residuals from other demonstrated technologies (identified in Section 3) used to treat the waste.

5.1 Nonwastewaters

EPA has data from the incineration of F and K wastes that contained constituents of concern in F025 wastes. The data from treatment of waste codes K001 and K019 (used to develop the F025 nonwastewater treatment standards) show nondetectable levels for the constituents of concern in the treated residuals. Because the treated residuals are below the detection limits, the Agency does not expect that better treatment can be achieved for the constituents of concern.

Because data from the other demonstrated technologies (identified in Section 3) are not available, the Agency cannot compare performance to determine which technology is "best." However, since incineration treats to nondetectable levels, the Agency would not expect the level of performance to be improved by the other demonstrated technologies when compared to incineration.

EPA reviewed all the performance data available to determine whether substantial treatment was provided. The parameters examined included (1) the design and operating conditions, (2) the analytical testing, and (3) the quality assurance/quality control analyses of the data. After review of these parameters, EPA concluded that the data on which the Agency is basing treatment standards are of sufficient quality and show substantial treatment for the constituents of concern (because the constituents of concern in the residuals were treated below the detection limits). Design and operating condition data indicate that the treatment systems were all well designed and well operated during the test burns. In addition, the proper analytical tests and quality assurance techniques were performed on the untreated wastes and treated residuals. (For additional information on determination of BDAT, see EPA's Methodology for Developing Best Demonstrated Available Technology (BDAT) Treatment Standards (USEPA 1989b.)

In addition, incineration is a commercially available technology. Since the criteria for best, demonstrated, and available have been met, the Agency has determined that incineration is BDAT for the organic constituents of F025 wastes.

5.2 Wastewasters

For constituents of concern in F025 wastewaters, the Agency has treatment data from various sources. As discussed in Section 4 of this document, these sources include (1) ITD, (2) WERL, and (3) EPA's WAO and PACT treatment data. Treatment performance data from these sources were evaluated to determine which data set represented the "best" treatment performance data for the constituents of concern in F025 wastewaters. Based on the data available to the Agency, the best demonstrated available technologies for the constituents of concern in F025 wastewaters are biological treatment for carbon tetrachloride; steam

stripping for chloroform, 1,2-dichloroethane, 1,1-dichloroethylene, methylene chloride, 1,1,2-trichloroethane, trichloroethylene, and vinyl chloride; and activated sludge followed by filtration for hexachlorobenzene, hexachlorobutadiene, and hexachloroethane. A discussion of the BDAT evaluation for each constituent of concern in F025 wastewaters is included in Appendix B of this document. For additional information on the methodology used to screen these wastewater data, a description of the data bases, and codes for plants in these data bases, see the Final BDAT Background Document for Organic U and P Waste and Multi-Source Leachate, Volume A: Wastewater Forms of Organic U and P Waste and Multi-Source Leachate for Which There Are Concentration-Based Standards (USEPA 1989h).

6. CALCULATION OF PROPOSED BDAT TREATMENT STANDARDS

The Agency bases numerical treatment standards for regulated constituents on the performance of well-designed and well-operated BDAT treatment systems. These standards account for analytical limitations in available treatment performance data and for variabilities related to treatment, sampling, and analytical techniques and procedures. The purpose of this section is to present the calculation of treatment standards for the F025 constituents using the available treatment performance data from the BDAT treatment technologies. The Agency has approved analytical methods for all of these wastes. Therefore, the Agency is promulgating concentration-based treatment standards to be met before the wastes may be disposed of on land when the standard becomes effective December 11, 1990. The Agency has determined that F025 wastes may be present as wastewaters and nonwastewaters; therefore, the Agency is promulgating treatment standards for both of these forms. A discussion of how the treatment standards for these wastes were calculated is included in this section. For further information on the calculation of BDAT treatment standards see the EPA document Methodology for developing Best Demonstrated Available Technology (BDAT) Treatment Standards (USEPA 1989b).

6.1 Nonwastewaters

Treatment standards for constituents of concern in F025 nonwastewaters were calculated as follows. The Agency reviewed its BDAT incineration data base and selected the K019 performance data to be used for calculating the nonwastewater treatment standards for all the constituents in Tables 1-1 through 1-4 (except vinyl chloride). The Agency used the K019 treatment performance data because the K019 untreated waste contained many of the constituents also present in F025 waste, i.e., chloroform, 1,1-dichloroethane, 1,2-dichloroethylene,

carbon tetrachloride, trichloroethylene, hexachlorobenzene, hexachlorobutadiene, and hexachloroethane.* Also, K019 was considered a relatively difficult waste matrix to treat based on the waste characteristics affecting performance, i.e., bond dissociation energy, boiling points, and parameters affecting treatment. Further, the K019 untreated waste contained significant concentrations of the constituents of concern in F025 (ranging from 85 mg/kg for hexachloroethane to 130,000 mg/kg for 1,2-dichloroethane). Further, all constituents of concern were treated to nondetectable levels in the treated ash and scrubber water residuals.

K001 (creosote) data showed the highest detection limit for any waste in which vinyl chloride was present in the untreated waste. The Agency therefore used the K001 (creosote) performance data to develop the vinyl chloride standard in F025 nonwastewaters. The Agency also used these data for the vinyl chloride (U043) standard for the Third Third rulemaking.

Treatment standards for F025 nonwastewaters were calculated by multiplying the highest detection limit for each waste constituent first by the highest analytical recovery factor (i.e., lowest percent recovery) for that constituent or a similar constituent and then by a variability factor of 2.8 (used when the treated residuals are below the detection limit). Appendix A presents the matrix spike recoveries for the kiln ash residue for K001 and K019.

Before the treatment standards were calculated, the treatment performance data were corrected to account for analytical interferences associated with the chemical matrices of the samples. The treatment performance data were corrected by applying the lowest percent recovery calculated for that constituent. The correction factor was then

---

* Hexachlorobutadiene was present in a RCRA blend waste that was incinerated with the K019 waste.

calculated as the reciprocal of the lowest percent recovery. The detection limits were then multiplied by this correction factor. Wherever EPA transferred the performance data (for constituents not present in the untreated waste), the Agency used the lowest percent recovery value from the constituent from which the transfer was made. If recovery values were not available for a constituent, the Agency selected the lowest average percent recovery for the acid extractables or base-neutral extractables, semivolatiles, or volatiles (depending on the group to which the constituent belonged).

Since the K001 (creosote) and K019 treatment performance data show that all the constituents of concern in F025 waste were treated below the detection limits, the Agency decided to use the detection limit data to calculate the treatment standard.

The next step in calculating treatment standards is to determine the variability factor (VF) for each regulated constituent. The variability factor accounts for the variability inherent in treatment system performance, treatment residual collection, and analysis of the treated waste samples. F025 constituents of concern in K001 and K019 treated residuals were treated below the detection limit. Where concentrations in the treated waste were reported at less than or equal to the detection limit for all test runs for a specific constituent, variability was still expected since the actual concentration could range from 0 to the detection limit. In these cases, the Agency assumed a lognormal distribution of data points between the detection limit and a value one-tenth of the detection limit and calculated a variability of 2.8. (For more information on the calculation of variability factors, see EPA's Methodology for Developing BDAT Treatment Standards. (USEPA 1989b).)

Finally, treatment standards were calculated by multiplying the corrected treatment performance values by the variability factor of 2.8 for each constituent.

Tables 6-1 and 6-2 (at the end of this section) summarize the calculation of treatment standards for the wastes included in this document. Sections 6.1.1 and 6.1.2 describe the transfer of treatment data and the calculation of the treatment standards in greater detail.

6.1.1 Calculation of Treatment Standards for Nonwastewater Forms of F025 Constituents, i.e., Chloroform, Vinyl Chloride, Trichloroethylene, 1,2-Dichloroethane, Carbon Tetrachloride, Hexachloroethane, Hexachlorobenzene, and Hexachlorobutadiene

The treatment standards for the above-mentioned nonwastewater forms of F025 constituents were calculated using treatment performance data from incineration of K011 (creosote) and K019. All of the above-mentioned constituents were present in the K011 and K019 untreated wastes; therefore, the treatment standards were calculated by multiplying the highest detection limit for the constituent of concern times the analytical accuracy-correction factor times a variability factor of 2.8.

6.1.2 Calculation of Treatment Standards for Nonwastewater Forms of F025 Constituents, i.e., 1,1,2-Trichloroethane, Methylene Chloride, and 1,1-Dichloroethylene

Where data are not available on the treatment technology of concern, the Agency may elect to transfer data on the treatment of a similar waste or wastes, using a demonstrated technology. To transfer data from another waste category, EPA must find that the wastes to be regulated are no more difficult to treat (based on the waste characteristics that affect performance of the demonstrated treatment technology) than the treated wastes from which performance data are being transferred.

The transfer of treatment data is supported by the determination that these wastes are part of a single waste treatability group. The determination of the waste treatability group is based on the similarity in composition of the untreated wastes, the fact that all of these wastes are generated by the organic chemicals industry, and the Agency's belief that the constituents in these wastes can be treated to similar concentrations using the same technology.

The particular constituent from which data are transferred is determined based on the characteristics of the waste that affect treatment performance by incineration with respect to the nonwastewater residual (i.e., incinerator ash). In an incinerator, energy in the form of heat is transferred to the waste to volatilize the organic waste constituents prior to combustion. To determine whether one constituent is equally difficult or more difficult to volatilize than another constituent, the Agency examines the boiling points of the constituents. In general, the Agency believes that a constituent with a higher boiling point (bp) is more difficult to treat than a constituent with a lower boiling point.

The Agency also considers the bond dissociation energy (BDE) of the constituents of concern in determining the incinerability and considers constituents with higher BDEs more difficult to treat than constituents with lower BDEs. In all cases the BDE of the constituent from which the transfer is being made is higher than the BDE of the constituent to which the transfer is to be applied.

Therefore, treatment performance data were transferred to untested nonwastewaters from constituents detected in tested untreated wastes that had equal or higher boiling points and/or higher BDEs (as discussed below).

Incineration performance data were not available from K001, K019, F024, or the Agency's 1989 John Zink Test Burn for the following F025 constituents: 1,1,2-trichloroethane, methylene chloride, and 1,1-dichloroethylene. Therefore, EPA decided to transfer the performance data from similar constituents in K019 to the constituents of concern in F025 wastes. The following is a detailed description of the transfer methodology associated with each of these constituents of F025 wastes.

(1) 1,1-Dichloroethylene. The treatment standard for 1,1-dichloroethylene (bp 31.9°C; BDE 515 kcal/mol) is based on data transferred from the treatment of 1,1-dichloroethane in K019 (bp 57.15°C; BDE 645 kcal/mol) because 1,1-dichloroethane has a higher bp and BDE than 1,1-dichloroethylene. In addition, 1,1-dichloroethane test data from K019 were used to regulate 1,1-dichloroethylene when 1,1-dichloroethylene appeared in waste code K029. Based on these waste characteristics that affect treatment performance for incineration. the Agency expects that 1,1-dichloroethylene can be treated to concentrations as low as or lower than those of 1,1-dichloroethane.

(2) Methylene chloride. The treatment standard for methylene chloride (bp 41°C; BDE 370 kcal/mol) is based on data transferred from treatment of 1,1-dichloroethane (bp 57.15°C; BDE 645 kcal/mol) in K019. Based on these waste characteristics affecting treatment performance of incineration, the Agency expects that methylene chloride can be treated to concentration levels as low as or lower than those of 1,1-dichloroethane.

(3) 1,1,2-Trichloroethane. The treatment standard for 1,1,2-trichloroethane (BDE 640 kcal/mol) is based on data transferred from 1,1,1-trichloroethane in K019 because 1,1,1-trichloroethane has an identical BDE of 640 kcal/mol. Based on this waste characteristic that

affects treatment performance for incineration, the Agency expects that 1,1,2-trichloroethane can be treated to concentrations as low as those of 1,1,1-trichloroethane.

6.2 Wastewaters

The BDAT treatment standards for the wastewater forms of the constituents of concern in F025 wastes (identified in Tables 1-1 through 1-4) are the same as those used for developing the treatment standards for Organic U and P Waste and Multi-Source Leachate Volume A: Wastewater Forms of Organic U and P wastes and Multi-Source Leachate for Which There Are Concentration-Based Treatment Standards. The discussion of BDAT and calculation of treatment standards for F025 wastewater constituents have been excerpted from that document and are presented in Appendix B of this document.

Table 6-1 Calculation of Treatment Standards for F025
(Nonwastewaters)

Constituent	Waste detection limit transferred from	Highest detection limit (DL) (ppm)	Accuracy correction factor (ACF)	Accuracy correction factor transferred from	Variability factor (VF)	Treatment standard (ppm) (DL x ACF x VF)
Chloroform	K019	2.0	1.10	Chloroform, K019	2.8	6.2
Carbon Tetrachloride	K019	2.0	1.10	1,1,1-Trichloroethane, K019	2.8	6.2
1,2-Dichloroethane	K019	2.0	1.10	1,2-Dichloroethane, K019	2.8	6.2
1,1-Dichloroethylene	K019	2.0	1.10	1,1-Dichloroethane, K019	2.8	6.2
Methylene Chloride	K019	10.0	1.10	1,1-Dichloroethane, K019	2.8	31
1,1,2-Trichloroethane	K019	2.0	1.10	1,1,2-Trichloroethane, K019	2.8	6.2
Trichloroethylene	K019	2.0	1.0	1,2,4-Trichloroethylene, K019	2.8	5.6
Hexachloroethane	K019	10.0	1.06	Hexachloroethane, K019	2.8	30
Hexachlorobenzene	K019	10.0	1.33	1,2,4-Trichlorobenzene, K019	2.8	37
Hexachlorobutadiene	K019	10.0	1.0	Trichloroethylene, K019	2.8	28
Vinyl Chloride	K001 (creosote)	10.0	1.16	1,1-Dichloroethylene, K001 (creosote)	2.8	33

Table 6-2 Calculation of Treatment Standards for F025
(Wastewaters)

Constituent	Average Effluent concentration (AEC)	Variability factor (VF)	Treatment Standard (ppm) AEC x VF
Chloroform	0.012	3.71	0.046
Carbon Tetrachloride	0.01	5.73	0.057
1.2-Dichloroethane	0.02	8.22	0.21
1.1-Dichloroethylene	0.01	2.47	0.025
Methylene Chloride	0.023	3.8	0.089
1.1.2-Trichloroethane	0.01	5.3	0.054
Trichloroethylene	0.01	5.3	0.054
Hexachloroethane	0.01	5.53	0.055
Hexachlorobenzene	0.01	5.53	0.055
Hexachlorobutadiene	0.01	5.53	0.055
Vinyl Chloride	0.05	5.3	0.27

Note: EPA's Office of Water's Industrial Technology Division variability factor accounts for treatment and analytical variability; therefore, accuracy correction factors are not used.

7. REFERENCES

APHA, AWWA, and WPCF. 1985. American Public Health Association, American Water Works Association, and Water Pollution Control Federation. Standard methods for the examination of water and wastewater. 16th. ed. Washington, D.C.: American Public Health Association.

Dynamac Corporation. Memorandum to Larry Rosengrant, EPA Office of Solid Waste. Waste characterization for F025. November 1, 1989.

Dynamac Corporation. 1989. Memorandum from Barry Millman to Les Otte, EPA
Office of Solid Waste. Waste volumes and management for waste F025. August 22, 1989.

Environ Corporation. Characterization of Waste Streams Listed in 40 CFR Section 261, Waste Profiles Volume, 1.

SRI International. 1988. Directory of chemical producers--United States of America. Menlo Park, California: SRI International.

USEPA. 1984. U.S. Environmental Protection Agency. Draft listing background document for C1-C5 chlorinated aliphatic hydrocarbon production utilizing free radical catalyzed processes. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1988. U.S. Environmental Protection Agency, Office of Solid Waste. Best demonstrated available technology (BDAT) background document for K019 waste. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1989a. U.S. Environmental Protection Agency, Office of Solid Waste. Onsite engineering report of treatment technology performance and operation for John Zink Company. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1989b. U.S. Environmental Protection Agency, Office of Solid Waste. Methodology for developing best demonstrated available technology (BDAT) treatment standards. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1989c. U.S. Environmental Protection Agency, Office of Solid Waste. Best demonstrated available technology (BDAT) background document for halogenated pesticide and chlorobenzene, halogenated phenolic, and phenolic wastes. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1989d. U.S. Environmental Protection Agency, Office of Solid Waste. Proposed Best demonstrated available technology (BDAT) background document for miscellaneous halogenated organic wastes, wastes of a pharmaceutical nature, brominated organic wastes, organo-sulfur compound wastes, and organo-nitrogen compounds. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1989e. U.S. Environmental Protection Agency. Office of Solid Waste. Proposed best demonstrated available technology (BDAT) background document for halogenated aliphatic U-wastes. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1989f. U.S. Environmental Protection Agency, Office of Solid Waste. Treatment technology background document. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1989g. U.S. Environmental Protection Agency, Office of Solid Waste. Best demonstrated available technology (BDAT) background document for chlorinated aliphatics F024. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1989h. U.S. Environmental Protection Agency, Office of Solid Waste. Best demonstrated available technology (BDAT) background document for organic wastewater forms of organic U & P wastes and multi-source leachate for which there are concentration- based treatment standards.

APPENDIX A

MATRIX SPIKE RECOVERY DATA FOR K019, AND F024 NONWASTEWATERS

Appendix A. Matrix Spike Recoveries for Kiln Ash Residue (K019)

Spike constituent	Original amount found (ppb)	Sample result			Duplicate sample result		
		Amount spiked (ppb)	Amount recovered (ppb)	Percent[a] recovery[a] (%)	Amount spiked (ppb)	Amount recovered (ppb)	Percent recovery[a] (%)
VOLATILES							
4. Benzene	<2	25	22.6	90	25	21.2	85
7. Carbon Tetrachloride	*						
9. Chlorobenzene	<2	25	24.8	99	25	25	100
14. Chloroform	*						
22. 1,1,-Dichloroethane	*						
23. 1,2-Dichloroethane	*						
24. 1,1-Dichloroethylene	<2	25	21.2	85	25	19.4	78
42. Tetrachloroethene	*						
43. Toluene	*						
45. 1,1,1-Trichloroethane	*						

*No matrix spike was performed for this constituent. The percent recovery for this constituent is based on the lower average percent recovery of the volatile constituents. The lower average percent recovery is 90.75% from the duplicate sample result.

[a]Percent recovery = 100 x $(C_i - C_o)/C_t$, where C_i = amount recovered, C_o = original found, and C_t = amount spiked.

Source: USEPA 1988h.

Appendix A. Matrix Spike Recoveries for Kiln Ash Residue (K019) (continued)

Spike constituent	Original amount found (ppb)	Sample result: Amount spiked (ppb)	Sample result: Amount recovered (ppb)	Sample result: Percent recovery[a] (%)	Duplicate sample result: Amount spiked (ppb)	Duplicate sample result: Amount recovered (ppb)	Duplicate sample result: Percent recovery[a] (%)
SEMIVOLATILES (continued)							
109. Fluorene	+						
110. Hexachlorobenzene	+						
113. Hexachloroethane	+						
121. Naphthalene	+						
136. Pentachlorobenzene	+						
141. Phenanthrene	+						
145. Pyrene	<2	50	60	120 [b]	50	46	92
148. 1,2,4,5-Tetrachlorobenzene	+						
150. 1,2,4-Trichlorobenzene	<5	50	37.5	75	50	40	80
AVERAGE RECOVERY FOR SEMIVOLATILES (BASE/NEUTRAL)				94.16			95.1

+No matrix spike was performed for this constituent. The percent recovery for this constituent is based on the lower average percent recovery of the semivolatile (base/neutral) constituents. The lower average percent recovery is 94.16% from the duplicate sample result.

[a]Percent recovery = 100 x $(C_i - C_o)/C_t$, where C_i = amount recovered, C_o = original amount found, and C_t = amount spiked.

[b]Recovery values greater than 100 percent were considered as just 100 percent.

Source: USEPA 1988h.

Appendix A. Matrix Spike Recoveries for Kiln Ash Residue (K019) (continued)

Spike constituent	Original amount found (ppb)	Sample result: Amount spiked (ppb)	Sample result: Amount recovered (ppb)	Sample result: Percent* recovery[a] (%)	Duplicate sample result: Amount spiked (ppb)	Duplicate sample result: Amount recovered (ppb)	Duplicate sample result: Percent recovery[a] (%)
VOLATILES (continued)							
47. Trichloroethene	<2	25	26.8	107 [b]	25	28	112 [b]
AVERAGE RECOVERY FOR VOLATILES				93.5			90.75
SEMIVOLATILES (BASE/NEUTRAL FRACTION)							
52. Acenaphthene	<2	50	55	110 [b]	50	55	110 [b]
68. Bis(2-chloroethyl)ether	+						
70. Bis(2-ethylhexyl) phthalate	+						
88. 1,4,-Dichlorobenzene	<2	50	45	90	50	49.5	99
98. Di-n-butylphthalate	+						
102. 2,4-Dinitrotoluene	<50	50	53.5	107 [b]	50	55	110 [b]
105. N-Nitroso-di-n-propylamine	<5	50	60	120 [b]	50	65	130 [b]

+No matrix spike was performed for this constituent. The percent recovery for this constituent is based on the lower average percent recovery of the semivolatile (base/neutral) constituents. The lower average percent recovery is 94.16 from the duplicate sample result.

[a]Percent recovery = 100 x $(C_i - C_o)/C_t$, where C_i = amount recovered, C_o = original amount found, and C_t = amount spiked.

[b]Recovery values greater than 100 percent were considered as just 100 percent.

Source: USEPA 1988h.

K001 Creosote Ash Sample ZK01C-3-B2
VOA Matrix Spike Recoveries (%)

	Spike level (µg/L)	S710125 ZK01C-3-B2 #1	#2	RPD
1,1-Dichloroethene	25	86	95	9.9
Toluene	25	99	110 [a]	10
Chlorobenzene	25	102 [a]	112 [a]	9.3
Benzene	25	78	88	12
Trichlorethylene	25	67	77	14
Average percent recovery		86	92	

K001 Creosote Water Sample ZK01C-3-B2
VOA Matrix Spike Recoveries (%)

	Spike level (µg/L)	S710125 ZK01C-3-B2 #1	#2	RPD
1,1-Dichloroethene	25	100 [a]	97	3.0
Toluene	25	103 [a]	99	4.0
Chlorobenzene	25	95	90	5.4
Benzene	25	90	85	5.7
Trichlorethylene	25	69	64	7.5
Average percent recovery		90.8	87	

[a]Recovery values greater than 100 percent are considered as just 100 percent in calculating the average percent recovery.

Source: USEPA 1987.

APPENDIX B

DISCUSSION OF DETERMINATION OF BDAT FOR F025 WASTEWATER CONSTITUENTS

LIST OF ABBREVIATIONS

AL	Aerobic Lagoons
AS	Activated Sludge
AIRS	Air Stripping
CAC	Chemically Assisted Clarification
ChOx	Chemical Oxidation (Parentheses shows oxidation chemical (i.e., ChOx (Oz) - ozone)
ChOx/Pt	Chemical Oxidation/Precipitation
ChPt	Chemical Precipitation
Chred	Chemical Reduction
Chred/Pt	Chemical Reduction/Precipitation
FIL	Filtration
GAC	Activated Carbon (Granular)
Neut	Neutralization
PACT	Powdered Activated Carbon Addition to Activated Sludge
RO	Reverse Osmosis
SS	Steam Stripping
TF	Trickling Filter
WOx	Wet Air Oxidation

Carbon Tetrachloride. The data available for carbon tetrachloride were compiled from the WERL database, BDAT Solvents Rule data, and literature WAO and PACT data. These data are presented in Table 4-13. Demonstrated treatment technologies included activated lagoon (AL), activated sludge (AS), activated sludge and filtration (AS+Fil), AirS, BT, CAC, GAC, powdered activated carbon treatment (PACT), RO, steam stripping (SS), and wet air oxidation (WOx). The treatment performance data represent bench-, pilot-, and full-scale studies. The resulting effluent concentrations ranged from 0.200 ppb to 12,000 ppb.

The proposed and promulgated BDAT standard was set using BT technology and an achievable effluent of 10 ppb. BT was selected as BDAT because it represents full-scale data developed from ITD sampling and was used as part of the BDAT Solvents Rule. The effluent concentration achievable by this technology is supported by similar effluent concentrations from the SS and GAC treatment performance data.

The resulting BDAT treatment standard for carbon tetrachloride is 0.057 ppm, as shown in Table 6-2.

Chloroform. Several sources of wastewater treatment performance data were available for chloroform including data from the ITD and WERL data bases and literature WAO and PACT data. These data are presented in Table 4-9. Demonstrated treatment technologies included AL, AS, AS+Fil, AirS, CAC, CAC+AirS, chemical oxidation (ChOx), GAC, PACT, Ro, SS, TF, and WOx. The treatment performance data represent bench-, pilot-, and full-scale data.

The treatment performance data available from the ITD database were used for setting the proposed and promulgated BDAT standard for this constituent for the following reasons:

(1) The ITD data represent treatment performance data from the OCPSF sampling episodes. The data collected by ITD include long-term sampling of several industries. These data are therefore a good reflection of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The ITD data were carefully screened prior to inclusion in that database. These data were used in determining an ITD promulgated limit.

(3) A promulgated ITD limit represents data that have undergone both EPA and industry review and acceptance.

The BDAT for chloroform is SS. Using the ITD median long-term average and ITD Option 1 variability factors, a BDAT treatment standard equal to the ITD limit was calculated as shown in Table 6-2. The BDAT treatment standard for chloroform is 0.046 ppm.

1,2-Dichloroethane. Several sources of wastewater treatment performance data were available for 1,2-dichloroethane, including data from the ITD and WERL databases and literature WAO data. These data are presented in Table 4-10. Demonstrated treatment technologies included AL, AL+AS, AS, AS+Fil, AirS, CAC, PACT, RO, SS, TF, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the ITD database were used for setting the proposed and promulgated BDAT standard for this constituent for the following reasons:

(1) The ITD data represent treatment performance data from the OCPSF sampling episodes. The data collected by ITD include long-term sampling of several industries. These data are therefore a good reflection of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The ITD data were carefully screened prior to inclusion in that database. These data were used in determining an ITD promulgated limit.

(3) A promulgated ITD limit represents data that have undergone both EPA and industry review and acceptance.

The BDAT for 1,2-dichloroethane is SS. Using the ITD median long-term average and ITD Option 1 variability factors, a BDAT treatment standard equal to the ITD limit was calculated as shown in Table 6-2. The BDAT treatment standard for 1,2-dichloroethane is 0.21 ppm.

1,1-Dichloroethylene. Two sources of wastewater treatment performance data were available for 1,2-dichloroethylene, including data from the ITD and WERL databases. These data are presented in Table 4-11. Demonstrated treatment technologies included AL, AS, AirS, CAC, GAC, RO, SS, and TF. The treatment performance data represent pilot- and full-scale studies.

The treatment performance data available from the ITD database were used for setting the proposed and promulgated BDAT Standard for this constituent for the following reasons:

(1) The ITD data represent treatment performance data from the OCPSF sampling episodes. The data collected by ITD include long-term sampling of several industries. These data are therefore a good reflection of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The ITD data were carefully screened prior to inclusion in that database. These data were used in determining an ITD promulgated limit.

(3) A promulgated ITD limit represents data that have undergone both EPA and industry review and acceptance.

The BDAT for 1,2-dichloroethylene is SS. Using the ITD median long-term average and ITD Option 1 variability factors, a BDAT treatment standard equal to the ITD limit was calculated as shown in Table 6-2. The BDAT treatment standard for 1,1-dichloroethylene is 0.025 ppm.

Hexachlorobenzene. The data available for hexachlorobenzene were compiled from the WERL database and are presented in Table 4-18. Demonstrated treatment technologies included AS, AS+Fil, and GAC, all at full-scale facilities. The resulting effluent concentrations ranged from 0.01 ppb to 20 ppb.

The proposed and promulgated BDAT standard was set using AS+Fil technology and an achievable effluent of 10 ppb. AS+Fil was selected as BDAT since it represents full-scale data with an influent concentration greater than 100 ppb and a high removal efficiency.

The resulting BDAT treatment standard for hexachlorobenzene is 0.055 ppm as shown in Table 6-2.

Hexachlorobutadiene. The data available for hexachlorobutadiene were compiled from the WERL database and are presented in Table 4-19. Demonstrated treatment technologies included AS, AS+Fil, and GAC in both full-scale and pilot-scale studies. The resulting effluent concentrations ranged from 10 ppb to 20 ppb.

The proposed and promulgated BDAT standard was set using AS+Fil technology and achievable effluent of 10 ppb. AS+Fil was selected as BDAT since it represents full-scale data with an influent concentration greater than 100 ppb and a high removal efficiency.

The resulting BDAT treatment standard for hexachlorobutadiene is 0.055 ppm, as shown in Table 6-2.

Hexachloroethane. The data available for hexachloroethane were compiled from the WERL database and are presented in Table 4-17. Demonstrated treatment technologies included AS and AS+Fil in pilot- and full-scale studies. The resulting effluent concentration for both studies was 10 ppb.

The proposed and promulgated BDAT standard was set using AS+Fil technology and an achievable effluent of 10 ppb. AS+Fil was selected as BDAT since it represents full-scale treatment performance with a high removal efficiency.

The resulting BDAT treatment standard for hexachloroethane is 0.055 ppm, as shown in Table 6-2.

Methylene Chloride. Several sources of wastewater treatment performance data were available for methylene chloride, including data from the ITD and WERL databases, BDAT Solvents Rule data, and literature WAO and PACT data. These data are presented in Table 4-12. Demonstrated treatment technologies included AS, AS+Fil, AirS, AirS+GAC, BT, BT+AC, CAC+AirS, GAC, PACT, RO, SS, TF, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the ITD database were used for setting the proposed and promulgated BDAT standard for this constituent for the following reasons:

(1) The ITD data represent treatment performance data from the OCPSF sampling episodes. The data collected by ITD include long-term sampling of several industries. These data are therefore a good reflection of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The ITD data were carefully screened prior to inclusion in that database. These data were used in determining an ITD promulgated limit.

(3) A promulgated ITD limit represents data that have undergone both EPA and industry review and acceptance.

The BDAT for methylene chloride is SS. Using the ITD median long-term average and ITD Option 1 variability factors, a BDAT treatment standard equal to the ITD limit was calculated as shown in Table 6-2. The BDAT treatment standard for methylene chloride is 0.089 ppm.

1,1,2-Trichloroethane. Several sources of wastewater treatment performance data were available for 1,1,2-trichloroethane, including data from the ITD and WERL databases and literature PACT data. These data are presented in Table 4-14. Demonstrated treatment technologies included AS, PACT, SS, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the ITD database were used for setting the proposed and promulgated BDAT standard for this constituent for the following reasons:

(1) The ITD data represent treatment performance data from the OCPSF sampling episodes. The data collected by ITD include long-term sampling of several industries. These data are therefore a good reflection of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The ITD data were carefully screened prior to inclusion in that database. These data were used in determining an ITD promulgated limit.

(3) A promulgated ITD limit represents data that have undergone both EPA and industry review and acceptance.

The BDAT for 1,1,2-trichloroethane is SS. Using the ITD median long-term average and ITD Option 1 variability factors, a BDAT treatment standard equal to the ITD limit was calculated as shown in Table 4-14. The BDAT treatment standard for 1,1,2-trichloroethane is 0.054 ppm.

Trichloroethylene. Several sources of wastewater treatment performance data were available for trichloroethylene including data from the ITD and WER1 databases, BDAT Solvents Rule data, BDAT test data, and additional literature data. These data are presented in Table 4-15. Demonstrated treatment technologies included Chred, AS, AirS, BT, BT+AC, CAC+Air S, ChOx, GAC, PACT, RO, SS, TF, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the ITD database were used for setting the proposed and promulgated BDAT standard for this constituent for the following reasons:

(1) The ITD data represent treatment performance data from the OCPSF sampling episodes. The data collected by ITD include long-term sampling of several industries. These data are therefore a good reflection of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The ITD data were carefully screened prior to inclusion in that database. These data were used in determining an ITD promulgated limit.

(3) A promulgated ITD limit represents data that have undergone both EPA and industry review and acceptance.

The BDAT for trichloroethylene is SS. Using the ITD median long-term average and ITD Option 1 variability factors, a BDAT treatment standard equal to the ITD limit was calculated as shown in Table 6-2. The BDAT treatment standard for trichloroethylene is 0.054 ppm.

Vinyl Chloride. Two sources of wastewater treatment performance data were available for vinyl chloride, including data from the ITD and WERL databases. These data are presented in Table 4-16. Demonstrated treatment technologies included AS, AS+Fil, AirS, and SS. The treatment performance data represent pilot- and full-scale data.

The treatment performance data available from the ITD database were used for setting the proposed and promulgated BDAT standard for this constituent for the following reasons:

(1) The ITD data represent treatment performance data from the OCPSF sampling episodes. The data collected by ITD include long-term sampling of several industries. These data are therefore a good reflection of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The ITD data were carefully screened prior to inclusion in that database. These data were used in determining an ITD promulgated limit.

(3) A promulgated ITD limit represents data that have undergone both EPA and industry review and acceptance.

The BDAT for vinyl chloride is SS. Using the ITD median long-term average and ITD Option 1 variability factors, a BDAT treatment standard equal to the ITD limit was calculated as shown in Table 6-2. The BDAT treatment standard for vinyl chloride is 0.27 ppm.